Samuel Johnson's Book

AN
ESSAY
Towards a
New Theory
OF
VISION.

By GEORGE BERKELEY, M. A.
Fellow of *Trinity College*, *Dublin*.

The Second Edition.

DUBLIN:
Printed by AARON RHAMES, for JEREMY
PEPYAT, Bookſeller in *Skinner-Row*, 1709.

FLE 1870.60

HARVARD COLLEGE LIBRARY
FROM
THE BEQUEST OF
EVERT JANSEN WENDELL
1918

THE CONTENTS.

SECT. I. *Deſign.*

II. *Diſtance of it ſelf Inviſible.*

III. *Remote Diſtance perceiv'd rather by Experience, than by Senſe.*

IV. *Near Diſtance thought to be perceiv'd by the* Angle *of the* Optic Axes.

V. *Difference between this and the former manner of perceiving Diſtance.*

VI. *Alſo by Diverging Rays.*

VII. *This depends not on Experience.*

VIII. *Theſe the common Accounts, but not ſatisfactory.*

IX. *Some* Ideas *perceiv'd by mediation of others.*

X. *No* Idea *which is not it ſelf perceiv'd, can be the means of perceiving another.*

XI. *Diſtance perceiv'd by means of ſome other* Idea.

XII. *Thoſe Lines and Angles mention'd in* Optics, *are not themſelves perceiv'd.*

XIII. *Hence the Mind doth not perceive Diſtance by Lines and Angles.*

XIV. *Alſo becauſe they have no real Exiſtence.*

XV. *And becauſe they are inſufficient to explain the Phænomena.*

Sect. XVI. *The* Ideas *that ſuggeſt Diſtance are* 1ſt. *the Senſation ariſing from the turn of the Eyes.*

XVII. *Betwixt which and Diſtance there is no neceſſary Connexion.*

XVIII. *Scarce room for miſtake in this matter.*

XIX. *No regard had to the Angle of the* Optic Axes.

XX. *Judgment of Diſtance made with both Eyes, the Reſult of* Experience.

XXI. 2*dly. Confuſedneſs of Appearance.*

XXII. *This the occaſion of thoſe Judgments attributed to Diverging Rays.*

XXIII. *Objection Anſwer'd.*

XXIV. *What deceives the Writers of* Optics *in this matter.*

XXV. *The Cauſe, why one* Idea *may ſuggeſt another.*

XXVI. *This apply'd to Confuſion and Diſtance.*

XXVII. 3*dly, The ſtraining of the Eye.*

XXVIII. *The Occaſions which ſuggeſt Diſtance, have in their own Nature no Relation to it.*

XXIX. *A difficult Caſe propoſed by Dr.* Barrow *as repugnant to all the known* Theories.

XXX. *This Caſe contradicts a receiv'd Principle in* Catoptrics.

XXXI. *It is ſhewn to agree with the Principles we have laid down.*

XXXII. *This* Phænomenon *Illuſtrated.*

XXXIII. *It confirms the Truth of the Principle whereby it is explained.*

XXXIV. *Viſion when Diſtinct, and when Confus'd.*

XXXV. *The different Effects of Parallel, Diverging and Converging Rays,*

XXXVI. *How Converging, and Diverging Rays come to ſuggeſt the ſame Diſtance.*

Sect. XXXVII. *A Perſon extream Purblind wou'd judge aright in the foremention'd Caſe.*
XXXVIII. *Lines and Angles why uſeful in* Optics.
XXXIX. *The not underſtanding this, a cauſe of Miſtake.*
XL. *A Query propos'd by Mr.* Molyneux *in his* Dioptrics, *conſider'd.*
XLI. *One Born Blind wou'd not at firſt have any* Idea *of Diſtance by Sight.*
XLII. *This not agreeable to the common Principles.*
XLIII. *The proper Objects of Sight, not without the Mind, nor the Images of any thing without the Mind.*
XLIV. *This more fully explain'd.*
XLV. *In what Senſe we muſt be underſtood to ſee Diſtance and external Things.*
XLVI. *Diſtance and Things placed at a Diſtance, not otherwiſe perceiv'd by the Eye than by the Ear.*
XLVII. *The* Ideas *of Sight more apt to be confounded with the* Ideas *of Touch than thoſe of Hearing are.*
XLVIII. *How this comes to paſs.*
XLIX. *Strictly ſpeaking, we never ſee and feel the ſame thing.*
L. Objects *of* Sight *twofold Mediate and Immediate.*
LI. *Theſe hard to ſeparate in our Thoughts.*
LII. *The received Accounts of our perceiving Magnitude by Sight, falſe.*
LIII. *Magnitude perceiv'd as immediately, as Diſtance.*
LIV. *Two kinds of ſenſible Extenſion, neither of which is infinitely Diviſible.*

The Contents.

Sect. LV. *The Tangible Magnitude of an* Object *Steddy, the Viſible not.*
LVI. *By what means, Tangible Magnitude is perceiv'd by Sight.*
LVII. *This farther enlarged on.*
LVIII. *No neceſſary Connexion between Confuſion or Faintneſs of Appearance, and ſmall or great Magnitude.*
LIX. *The Tangible Magnitude of an* Object, *more heeded than the Viſible; and why.*
LX. *An Inſtance of this.*
LXI. *Men do not Meaſure by Viſible Feet or Inches.*
LXII, *No neceſſary Connexion between Viſible and Tangible Extenſion.*
LXIII. *Greater Viſible Magnitude might ſignifie Leſſer Tangible Magnitude.*
LXIV. *The Judgments we make of Magnitude depend altogether on Experience.*
LXV. *Diſtance and Magnitude ſeen as Shame or Anger.*
LXVI. *But we are prone to think otherwiſe, and why.*
LXVII. *The Moon ſeems greater in the* Horizon, *than in the* Meridian.
LXVIII. *The cauſe of this Phænomenon, aſſigned.*
LXIX. *The Horizontal Moon, why greater at one time than another.*
LXX. *The Account we have given, proved to be true.*
LXXI. *And confirmed, by the Moon's appearing greater in a Miſt.*
LXXII. *Objection anſwer'd.*
LXXIII. *The way wherein Faintneſs ſuggeſts greater Magnitude Illuſtrated.*

The Contents.

Sect. LXXIV. *Appearance of the Horizontal Moon, why thought difficult to explain.*
LXXV. *Attempts towards the Solution of it made by ſeveral, but in vain.*
LXXVI. *The Opinion of Dr.* Wallis.
LXXVII. *It is ſhewn to be unſatisfactory.*
LXXVIII. *How Lines and Angles may be of uſe in computing apparent Magnitudes.*
LXXIX. *One born Blind, being made to See, what Judgment he'd make of Magnitude.*
LXXX. *The* Minimum Viſibile *the ſame to all Creatures.*
LXXXI. *Objection Anſwered.*
LXXXII. *The Eye at all times, perceives the ſame number of viſible Points.*
LXXXIII. *Two Imperfections in the* Viſive Faculty.
LXXXIV. *Anſwering to which, we may conceive two Perfections.*
LXXXV. *In neither of theſe two Ways do Microſcopes improve the Sight.*
LXXXVI. *The Caſe of Microſcopical Eyes, conſider'd.*
LXXXVII. *The Sight, admirably adapted to the ends of Seeing.*
LXXXVIII. *Difficulty concerning Erect Viſion.*
LXXXIX. *The common way of Explaining it*
XC. *The ſame ſhewn to be falſe.*
XCI. *Not diſtinguiſhing between* Ideas *of Sight and Touch, Cauſe of Miſtake, in this matter.*
XCII. *The Caſe of one Born Blind, proper to be conſider'd.*

Sect. XCIII. *Such a one might by Touch, attain to have* Ideas *of* Upper *and* Lower.

XCIV. *Which Modes of Situation he'd attribute only to things Tangible.*

XCV. *He'd not at firſt Sight think any thing he ſaw, High or Low, Erect or Inverted.*

XCVI. *This Illuſtrated by an Example.*

XCVII. *By what means he'd come to denominate Viſible* Objects, *high or low,* &c.

XCVIII. *Why he ſhou'd think thoſe* Objects *higheſt, which are Painted on the loweſt part of his Eye, and* vice verſâ.

XCIX. *How he wou'd perceive by Sight, the Situation of External Objects.*

C. *Our propenſion to think the contrary, no Argument againſt what hath been ſaid.*

CI. *Objection.*

CII. *Anſwer*

CIII. *An Object cou'd not be known at firſt Sight by the Colour.*

CIV. *Nor by the Magnitude thereof.*

CV. *Nor by the Figure.*

CVI. *In the firſt act of Viſion, no Tangible Thing wou'd be ſuggeſted by Sight.*

CVII. *Difficulty propoſed concerning Number.*

CVIII. *Number of things Viſible, wou'd not at firſt Sight ſuggeſt the like number of things Tangible.*

CIX. *Number, the Creature of the Mind.*

CX. *One Born Blind wou'd not at firſt Sight, number Viſible Things as others do.*

CXI. *The Situation of any Object, determin'd with reſpect only to Objects of the ſame Senſe.*

CXII. *No Diſtance, great or ſmall, between a Viſible and Tangible Thing.*

Sect. CXIII. *The*

Sect. CXIII. *The not obſerving this, cauſe of Difficulty in Erect Viſion.*

CXIV. *Which otherwiſe includes nothing unaccountable.*

CXV. *What is meant by the Pictures being inverted.*

CXVI. *Cauſe of Miſtake in this Matter.*

CXVII. *Images in the Eye, not Pictures of external Objects.*

CXVIII. *In what Senſe they are Pictures.*

CXIX. *In this Affair we muſt carefully diſtinguiſh between Ideas of Sight and Touch.*

CXX. *Difficult to explain by Words the true* Theory *of* Viſion.

CXXI. *The Queſtion, whether there is any* Idea *common to* Sight *and* Touch, *ſtated.*

CXXII. *Abſtract Extenſion enquir'd into.*

CXXIII. *It is Incomprehenſible.*

CXXIV. *Abſtract Extenſion not the* Object *of Geometry.*

CXV. *The general* Idea *of a Triangle, conſider'd.*

CXXVI. *Vacuum or pure Space, not common to Sight and Touch.*

CXXVII. *There is no Idea or kind of Idea, common to both Senſes.*

CXXVIII. *Firſt Argument in Proof hereof.*

CXXIX. *Second Argument.*

CXXX. *Viſible Figure and Extenſion, not diſtinct* Ideas *from Colour.*

CXXXI. *Third Argument.*

CXXXII. *Confirmation drawn from Mr.* Molyneux's *Problem of a Sphere and a Cube, publiſh'd by Mr.* Locke.

Sect. CXXXIII. *Which is falſely ſolved, if the common Suppoſition be true.*

CXXXIV. *More might be ſaid in proof of our Tenent, but this ſuffices*

CXXXV. *Farther Reflexion, on the foregoing Problem.*

CXXXVI. *The ſame thing doth not affect both ſight and Touch.*

CXXXVII. *The ſame Idea of Motion not common to Sight and Touch.*

CXXXVIII. *The way wherein we apprehend Motion by Sight, eaſily collected from what hath been ſaid.*

CXXXIX. Qu. *How Viſible and Tangible* Ideas *came to have the ſame Name if not of the ſame Kind.*

CXL. *This accounted for without ſuppoſing them of the ſame Kind.*

CXLI. Obj. *That a Tangible Square is liker to a Viſible Square than to a Viſible Circle.*

CXLII. Anſw. *That a Viſible Square is fitter than a Viſible Circle, to repreſent a Tangible Square.*

CXLIII. *But it doth not hence follow, that a Viſible Square is like a Tangible Square.*

CXLIV. *Why we are more apt to confound Viſible with Tangible* Ideas, *than other Signs with the Things ſignify'd.*

CXLV. *Several other Reaſons hereof, aſſign'd.*

CXLVI. *Reluctancy in rejecting any Opinion, no Argument of its Truth,*

CXLVII. *Proper Objects of Viſion the Language of ~~ing~~ Nature.*

CXLVIII. *In it there is much admirable, and deſerv-our Attention.*

CXLIX. *Queſtion propos'd, concerning the Object of Geometry.*

The Contents.

Sect. CL. *At firſt View, we are apt to think Viſible Extenſion the Object of Geometry.*

CLI. *Viſible Extenſion ſhewn not to be the Object of Geometry.*

CLII. *Words may as well be thought the Object of Geometry, as Viſible Extenſion.*

CLIII. *It is propos'd to enquire, what Progreſs an Intelligence that cou'd ſee, but not feel, might make in Geometry.*

CLIV. *He cannot underſtand thoſe Parts which relate to Solids, and their Surfaces, and Lines generated by their Section.*

CLV. *Nor even the Elements of plain Geometry.*

CLVI. *The proper Objects of Sight incapable of being managed as Geometrical Figures.*

CLVII, *The Opinion of thoſe who hold plain Figures to be the Immediate Objects of Sight, conſidered.*

CLVIII. *Plains no more the immediate Objects of Sight, than Solids.*

CLIX. *Difficult to enter preciſely into the Thoughts of the above-mentioned Intelligence.*

CLX. *The Object of Geometry, its not being ſufficiently underſtood, cauſe of Difficulty and uſeleſs Labour in that Science.*

ERRATA.

ERRATA.

PAge 41. l. 18, dele *this*. p. 64. l. 20, r. *and*. p. 72. l. 12. r. *emancipate*. p. 94. l. 13. r. *Objects*. p. 100. l. 8. r. *nothing*. p. 102. l. 25. r. *acquieſced*. p. 153. l. 19. r. *Homogeneous*. p. 167. l. 2. r. *Figures*. p. 168 l. 24. for *this*, r. *their*. p. 170. l. 2. r. *it is*.

AN ESSAY TOWARDS *A New Theory of Viſion.*

I. *Deſign.*

MY Deſign is to ſhew the manner, wherein we perceive by Sight the Diſtance, Magnitude, and Situation of Objects. Alſo to conſider the Difference there is betwixt the *Ideas* of Sight and Touch, and whether there be any *Idea* common to both Senſes.

II. *Diſtance of it ſelf Inviſible.*

It is, I think, agreed by all that *Diſtance* of it ſelf, and immediately cannot be ſeen. For *Diſtance* being a Line directed end-wiſe to the Eye, it projects only one Point in the Fund of the Eye, Which Point remains invariably the ſame, whether the Diſtance be longer or ſhorter.

III. *Remote Diſtance perceiv'd rather by Experience, than by Senſe.*

I FIND it alſo acknowledg'd, that the Eſtimate we make of the Diſtance of Objects conſiderably remote, is rather an Act of Judgment grounded on *Experience*, than of *Senſe*. For Example, When I perceive a great number of intermediate Objects, ſuch as Houſes, Fields, Rivers, and the like, which I have experienced to take up a conſiderable Space; I thence form a Judgment or Concluſion, that the Object I ſee beyond them is at a great Diſtance. Again, when an Object appears Faint and Small, which at a near Diſtance I have experienced to make a vigorous and large Appearance; I inſtantly conclude it to be far off. And this, 'tis evident, is the reſult of *Experience*; without which, from the Faintneſs and Littleneſs,

tleneſs, I ſhould not have infer'd any thing concerning the Diſtance of Objects.

IV.
Near Diſtance thought to be perceived by the Angle *of the* Optic Axes.

BUT when an Object is placed at ſo near a Diſtance, as that the Interval between the Eyes bears any ſenſible Proportion to it. It is the Opinion of ſome that the two *Optic Axes* (the Fancy that we ſee only with one Eye at once being exploded) concurring at the Object do there make an *Angle*, by means of which, according as it is Greater or Leſſer, the Object is perceiv'd to be nearer or farther off.

V.
Difference between this and the former manner of perceiving Diſtance.

BETWIXT which, and the foregoing manner of Eſtimating Diſtance, there is this remarkable Difference. That whereas, there was no apparent, neceſſary Connexion between ſmall Diſtance and a large and ſtrong Appearance, or between great Diſtance, and a little and faint Appearance. Yet there appears a very neceſſary Connexion between an obtuſe Angle and near Diſtance, and an acute Angle and farther Diſtance. It does not in the leaſt depend upon Experience, but may be evidently known by any one before he had experienc'd it, that the nearer the Concurrence of the *Optic Axes*, the greater the *Angle*, and the remoter their Concurrence is, the leſſer will be the *Angle* comprehended by them.

VI. *Alſo by Diverging Rays.* THERE is another way, mention'd by *Optic Writers*, whereby they will have us judge of thoſe Diſtances, in reſpect of which, the breadth of the *Pupil* hath any ſenſible bigneſs. And that is the greater or leſſer Divergency of the Rays, which iſſuing from the viſible Point, do fall on the *Pupil*: That Point being judged neareſt, which is ſeen by moſt diverging Rays; and that remoter, which is ſeen by leſs diverging Rays. And ſo on, the apparent Diſtance ſtill increaſing, as the Divergency of the Rays decreaſes, till at length it becomes infinite, when the Rays that fall on the *Pupil* are to Senſe Parellel. And after this manner it is ſaid we perceive Diſtance when we look only with one Eye.

VII. *This depends not on Experience.*

In this Caſe alſo, 'tis plain we are not beholding to Experience: It being a certain, neceſſary Truth, that the nearer the direct Rays falling on the Eye approach to a *Paralleliſm*, the farther off is the Point of their Interſection, or the viſible Point from whence they flow.

VIII. *Theſe the common Accounts, but not ſatisfactory.*

Now tho' the Accounts here given of perceiving near Diſtance by Sight are receiv'd for true by ſome, and accordingly made uſe of in determining the apparent Places of Objects, they do nevertheleſs ſeem to me very unſatisfactory: And that for theſe following Reaſons.

IX. *Some* Ideas *perceived by the mediation of others*

First, It is evident that when the

Mind perceives any *Idea*, not immediately and of it ſelf, it muſt be by the means of ſome other *Idea.* Thus, for Inſtance, the Paſſions which are in the Mind of another, are of themſelves, to me inviſible. I may nevertheleſs perceive them by Sight, tho' not immediately yet, by means of the Colours they produce in the Countenance. We do often ſee Shame or Fear in the Looks of a Man, by perceiving the Changes of his Countenance to Red or Pale.

X. *No* Idea *which is not it ſelf perceived, can be the means of perceiving another.*

MOREOVER it is evident, that no *Idea* which is not it ſelf perceiv'd, can be to me the means of perceiving any other *Idea.* If I do not perceive the Redneſs or Paleneſs of a Man's Face themſelves, it is impoſſible I ſhou'd perceive by them the Paſſions which are in his Mind.

XI. *Diſtance perceived by means of ſome other* Idea.

Now from *Sect.* II. 'Tis plain that Diſtance is in it's own nature imperceivable, and yet it is perceiv'd by Sight.

It remains therefore, that it be brought into view by means of ſome other *Idea*, that is it ſelf immediately perceiv'd in the Act of *Viſion*.

XII. *Thoſe Lines and Angles mentioned in* Optics *are not themſelves perceiv'd.*

BUT thoſe *Lines* and *Angles*, by means whereof ſome Men pretend to explain the Perception of Diſtance, are themſelves not at all perceiv'd, nor are they in Truth, ever thought of by thoſe unskilful in *Optics*. I appeal to any ones Experience, whether upon Sight of an Object, he compute it's Diſtance by the bigneſs of the *Angle*, made by the meeting of the two *Optic Axes?* Or whether he ever think of the greater or leſſer Divergency of the Rays, which arrive from any Point to his *Pupil*. Every one is himſelf the beſt Judge of what he perceives, and what not. In vain ſhall any Man tell me, that I perceive certain *Lines* and *Angles* which introduce into my Mind the various *Ideas* of *Diſtance*; ſo long as I my ſelf am conſcious of no ſuch thing.

SINCE

XIII. *Hence the Mind doth not perceive Diſtance by Lines and Angles.*

SINCE therefore thoſe *Angles* and *Lines* are not themſelvs perceiv'd by Sight, it follows from *Sect.* X. that the Mind does not by them judge of the Diſtance of Objects.

XIV. *Alſo becauſe they have no real Exiſtence.*

SECONDLY, The Truth of this Aſſertion will be, yet, farther evident to any one that conſiders thoſe *Lines* and *Angles* have no real Exiſtence in Nature, being only an *Hypotheſis* fram'd by *Mathematicians*, and by them introduc'd into *Optics*, that they might treat of that Science in a *Geometrical* way.

XV. *And becauſe they are inſufficient to explain the Phænomena.*

THE *Third* and Laſt Reaſon I ſhall give for my Rejecting that Doctrine, is, that tho' we ſhould grant the real Exiſtence of thoſe *Optic Angles*, &c. and that it was poſſible for the Mind to perceive them; yet theſe Principles wou'd not be found ſufficient to explain the *Phænomena* of *Diſtance*. As ſhall be ſhewn hereafter.

Now

XVI. *The* Ideas *that ſuggeſt Diſtance are* 1ſt. *the Senſation ariſing from the turn of the Eyes.*

Now, It being already ſhewn that Diſtance is ſuggeſted to the Mind, by the Mediation of ſome other *Idea* which is it ſelf perceiv'd in the Act of Seeing. It remains that we enquire what *Ideas*, or *Senſations* there be that attend *Viſion*, unto which we may ſuppoſe the *Ideas* of Diſtance are connected, and by which they are introduced into the Mind. And *Firſt*, It is certain by Experience, that when we look at a near Object with both Eyes, according as it approaches, or recedes from us, we alter the Diſpoſition of our Eyes, by leſſening or widening the Interval between the *Pupils*. This Diſpoſition or Turn of the Eyes is attended with a Senſation, which ſeems to me, to be that which in this Caſe brings the *Idea* of greater, or leſſer Diſtance into the Mind.

XVII. *Betwixt which and Diſtance there is no neceſſary Connexion.*

Not, that there is any natural or neceſſary Connexion between the Senſation we perceive by the Turn of the Eyes, and greater or leſſer Diſtance. But becauſe the Mind has by conſtant *Experience*, found the different Senſations correſponding to the different Diſpoſitions of the Eyes, to be attended each, with a different Degree of Diſtance in the Object: There has grown an Habitual or Cuſtomary Connexion, between thoſe two ſorts of *Ideas*. So that the Mind no ſooner perceives the Senſation ariſing from the different Turn it gives the Eyes, in order to bring the *Pupils* nearer, or farther aſunder; but it withal perceives the different *Idea* of Diſtance which was wont to be connected with that Senſation. Juſt as upon hearing a certain Sound, the *Idea* is immediately ſuggeſted to the Underſtanding, which Cuſtom had united with it.

Nor

XVIII. *Scarce room for Miſtake in this matter.*

Nor do I ſee, how I can eaſily be miſtaken in this Matter. I know evidently that Diſtance is not perceived of it ſelf. That by conſequence, it muſt be perceived by means of ſome other *Idea* which is immediately perceived, and varies with the different Degrees of Diſtance. I know alſo that the Senſation ariſing from the Turn of the Eyes is of it ſelf, immediately perceived, and various Degrees thereof are connected with different Diſtances; which never fail to accompany them into my Mind, when I view an Object diſtinctly with both Eyes, whoſe Diſtance is ſo ſmall that in reſpect of it, the Interval between the Eyes has any conſiderable Magnitude.

XIX. *No regard had to the Angle of the* Optic Axes.

I know it is a receiv'd Opinion, that by altering the diſpoſition of the Eyes, the Mind perceives whether the Angle of the *Optic Axes* is made greater or leſſer. And that accordingly by a kind of *Natural Geometry*, it judges the Point of their Interſection to be nearer, or farther off. But that this is not true, I am convinc'd by my own Experience. Since I am not conſcious, that I make any ſuch uſe of the Perception I have by the Turn of my Eyes. And for me to make thoſe Judgments, and draw thoſe Concluſions from it, without knowing that I do ſo, ſeems altogether incomprehenſible.

XX. *Judgment of Diſtance made with both Eyes, the Reſult of* Experience.

From all which it plainly follows, that the Judgment we make of the Diſtance of an Object, viewed with both Eyes, is entirely the *Reſult of Experience*. If we had not conſtantly found certain Senſations ariſing from the various Diſpoſition of the Eyes, attended with certain Degrees of Diſtance. We ſhou'd never make thoſe ſudden Judgments from them, concerning the Diſtance of Objects; no more than we wou'd pretend to judge of a Man's Thoughts, by his pronouncing Words we had never heard before.

XXI. 2dly, *Confuſedneſs of Appearance.*

Secondly, An Object placed at a certain Diſtance from the Eye, to which the breadth of the *Pupil* bears a conſiderable Proportion, being made to approach, is ſeen more confuſedly. And the nearer it is brought, the more confuſed Appearance it makes. And this being found conſtantly to be ſo, there ariſes in the Mind an *Habitual* Connexion between the ſeveral Degrees of Confuſion and Diſtance. The greater Confuſion ſtill implying the leſſer Diſtance, and the leſſer Confuſion, the greater Diſtance of the Object.

XXII. *This the occaſion of thoſe Judgments attributed to diverging Rays.*

THIS confuſed Appearance of the Object, doth therefore ſeem to me to be the *Medium*, whereby the Mind judges of Diſtance in thoſe Caſes, wherein the moſt approv'd Writers of *Optics* will have it judge, by the different Divergency, with which the Rays flowing from the Radiating Point fall on the *Pupil.* No Man, I believe, will pretend to ſee or feel thoſe imaginary Angles, that the Rays are ſuppoſed to form according to their various Inclinations on his Eye. But he cannot chooſe ſeeing whether the Object appear more, or leſs confuſed. It is therefore a manifeſt Conſequence from what has been Demonſtrated, that inſtead of the greater, or leſſer Divergency of the Rays, the Mind makes uſe of the greater or leſſer Confuſedneſs of the Appearance, thereby to determine the apparent Place of an Object.

XXIII. *Objection anſwer'd.*

Nor doth it avail to ſay, there is not any neceſſary Connexion between confuſed *Viſion*, and Diſtance great, or ſmall. For I ask any Man, What neceſſary Connexion he Sees, between the Redneſs of a Bluſh and Shame? And yet no ſooner ſhall he behold that Colour to ariſe in the Face of another. But it brings into his Mind the *Idea* of that Paſſion which has been obſerved to accompany it.

XXIV. *What deceives the Writers of* Optics *in this matter.*

What ſeems to have miſled the Writers of *Optics* in this Matter is, that they imagine Men judge of Diſtance, as they do of a Concluſion in *Mathematics*; betwixt which and the Premiſes, it is indeed abſolutely requiſite there be an apparent, neceſſary Connexion. But it is far otherwiſe, in the ſudden Judgments Men make of Diſtance. We are not to think, that

Brutes and Children, or even grown reaſonable Men, whenever they perceive an Object to approach, or depart from them, do it by vertue of *Geometry* and *Demonſtration.*

XXV. *The Cauſe why one* Idea *may ſuggeſt another.*

THAT one *Idea* may ſuggeſt another to the Mind, it will ſuffice that they have been obſerv'd to go together; without any demonſtration of the neceſſity of their Coexiſtence, or without ſo much as knowing what it is that makes them ſo to Coexiſt. Of this there are innumerable Inſtances, of which no one can be Ignorant.

XXVI *This apply'd to Confuſion and Diſtance.*

THUS greater Confuſion having been conſtantly attended with nearer Diſtance, no ſooner is the former *Idea* perceived, but it ſuggeſts the latter to our Thoughts. And if it had been the ordinary Courſe of Nature, that the farther off an Object were placed, the more Confuſed it ſhou'd appear.

pear. It is certain, the very ſame Perception that now makes us think an Object approaches, would then have made us to imagine it went farther off. That Perception, abſtracting from *Cuſtom* and *Experience*, being equally fitted to produce the *Idea* of great Diſtance, or ſmall Diſtance, or no Diſtance at all.

XXVII. 3dly, *The ſtraining of the Eye*

Thirdly, AN Object being placed at the Diſtance above ſpecified, and brought nearer to the Eye, we may neverthelеſs prevent, at leaſt for ſome time, the Appearance's growing more Confus'd, by ſtraining the Eye. In which Caſe, that Senſation ſupplys the place of confuſed *Viſion*, in aiding the Mind to judge of the Diſtance of the Object. It being eſteemed ſo much the nearer, by how much the effort, or ſtraining of the Eye in order to diſtinct *Viſion*, is greater.

XXVIII. *The Occaſions which ſuggeſt Diſtance have in their own Nature no Relation to it.*

I HAVE here ſet down thoſe Senſations or *Ideas*, that ſeem to me to be the conſtant and general Occaſions

of

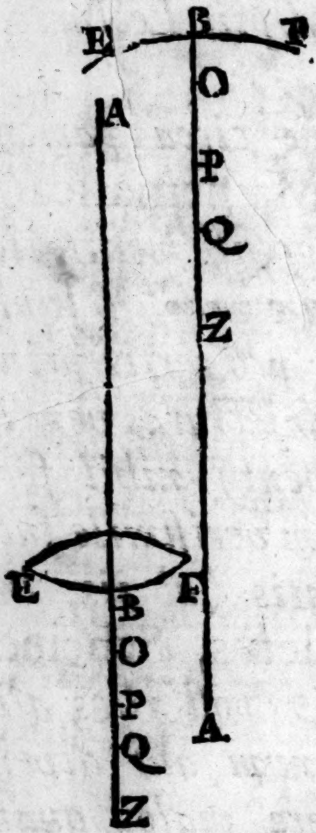
of introducing into the Mind, the different *Ideas* of near Diſtance. 'Tis true in moſt Caſes, that divers other Circumſtances contribute to frame our *Idea* of Diſtance, *viz.* the particular Number, Size, Kind, *&c.* of the things ſeen. Concerning which, as well as all other the forementioned Occaſions which ſuggeſt Diſtance, I ſhall only obſerve, they have none of them, in their own Nature, any Relation or Connexion with it. Nor is it poſſible, they ſhou'd ever ſignifie the various Degrees thereof, otherwiſe than as by *Experience* they have been found to be connected with them.

XXIX. *A difficult Caſe propoſed by Dr.* Barrow *as repugnant to all the known* Theories.

I SHALL proceed upon theſe Principles to account for a *Phænomenon*, which has hitherto ſtrangely puzzled the Writers of *Optics*, and is ſo far from being accounted for by any of their *Theories* of *Viſion*, that it is, by their own Confeſſion, plainly repugnant to them. And of Conſequence, if nothing elſe cou'd be objected, were alone ſufficient to bring their Credit in Queſtion. The whole Difficulty I ſhall lay before you in the Words of the Learned Doctor *Barrow*, with which he concludes his *Optic Lectures*.

> *Hæc ſunt, quæ circa partem* Opticæ *præcipue* Mathematicam *dicenda mihi ſuggeſſit meditatio. Circa reliquas, (quæ* φυσικώτεραι *ſunt, adeoque ſepiuſcule pro certis principiis plauſibiles conjecturas venditare neceſſum habent) nihil fere quicquam admodum veriſimile ſuccurrit, a pervulgatis (ab iis, inquam, quæ* Keplerus, Scheinerus, Carteſius, *& poſt illos alii tradiderunt) alienum aut diverſum. Atqui tacere malo, quam toties oblatam cramben reponere. Proinde receptui cano; nec ita tamen ut prorſus diſcedam anteaquam improbam quandam difficultatem (pro ſinceritate quam & vobis & veritati debeo minime diſſimulandam) in medium protulero, quæ doctrinæ noſtræ, hactenus inculcatæ, ſe objicit adver-*

ſam, ab ea ſaltem nullam admittit ſolutionem. Illa, breviter, talis eſt : Lenti vel Speculo cavo EBF *exponatur punctum viſibile* A, *ita Diſtans ut Radii* ex A *manantes ex inflexione verſus axem* A B *cogantur. Sitque radiationis Limes (ſeu puncti* A *imago, qualem ſupra paſſim ſtatuimus) punctum* Z. *Inter hoc autem & inflectentis verticem* B *uſpiam poſitus concipiatur Oculus. Quæri jam poteſt ubi loci debeat punctum* A *apparere? Retrorſum ad punctum* Z *videri non fert Natura (cum omnis impreſſio ſenſum afficiens proveniat a partibus* A) *ac experientia reclamat. Noſtris autem e placitis conſequi videtur, ipſum ad partes anticas apparens, ab intervallo longiſſime diſſito,*



diſſito, (quod & maximum ſenſibile quodvis Intervallum quodammodo exſuperet) apparere. Cum enim quo Radiis minus divergentibus attingitur Objectum, eo (ſecluſis utique prænotionibus & præjudiciis) longius abeſſe ſentiatur; et quod Parallelos ad Oculum Radios projicit, remotiſſime poſitum æſtimetur. Exigere Ratio videtur, ut quod convergentibus radiis apprehenditur, adhuc magis, ſi fieri poſſet, quoad apparentiam elongetur. Quin & circa Caſum hunc generatim inquiri poſſit, quidnam omnino ſit, quod apparentem puncti A *locum determinet, faciatque quod conſtanti ratione nunc propius, nunc remotius appareat? Cui itidem dubio, nihil quicquam ex hactenus dictorum* Analogia, *reſponderi poſſe videtur, niſi debere punctum* A *perpetuo longiſſime ſemotum videri. Verum experientia ſecus atteſtatur, illud pro diverſa Oculi inter puncta* B, Z, *poſitione varie diſtans; nunquam*

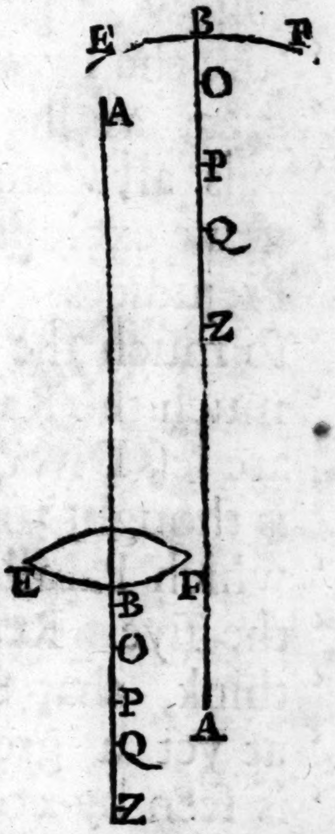
quam fere (ſi unquam) longinquius ipſo A *libere ſpectato, ſubinde vero multo propinquius adparere; quinimo, quo oculum appellentes radii magis convergunt eo ſpeciem Objecti propius accedere. Nempe, ſi puncto* B *admoveatur* Oculus, *ſuo (ad lentem) fere nativo in loco conſpicitur punctum* A (*vel æque diſtans, ad* Speculum;) *ad* O *reductus oculus ejuſce ſpeciem appropinquantem cernit; ad* P *adhuc vicinius ipſum exiſtimat; ac ita ſenſim, donec alicubi tandem, velut ad* Q, *conſtituto oculo objectum ſumme propinquum apparens, in meram confuſionem incipiat evaneſcere. Quæ ſane cuncta rationibus atque decretis noſtris repugnare videntur, aut cum iis ſaltem parum amice conſpirant. Neque noſtram tantum ſententiam pulſat hoc experimentum; at ex æquo cæteras quas norim omnes; veterem imprimis ac vulgatam noſtræ præ reliquis affinem ita convellere videtur, ut ejus vi coactus doctiſſi-*

mus A. Tacquetus *iſti principio (cui pene ſoli totam inædificaverat* Catoptricam *ſuam) ceu infido ac inconſtanti renunciarit, adeoque ſuam ipſe doctrinam labefactarit; id tamen, opinor, minime facturus, ſi rem totam inſpexiſſet penitius, atque difficultatis fundum attigiſſet. Apud me vero non ita pollet hæc, nec eouſque præpollebit ulla difficultas, ut ab iis quæ manifeſte rationi conſentanea video, diſcedam; prœſertim quum ut hic accidit, ejuſmodi difficultas in ſingularis cujuſpiam casûs diſparitate fundetur. Nimirum in præſente caſu peculiare quiddam, naturæ ſubtilitati involutum, deliteſcit, ægre fortaſſis, niſi perfectius explorato videndi modo, detegendum. Circa quod nil, fateor, hactenus excogitare potui, quod adblanderetur animo meo, nedum plane ſatisfaceret. Vobis itaque nodum hunc, utinam feliciore conatu, reſolvendum committo.*

In Engliſh as follows.

‘ I HAVE here delivered what my
‘ Thoughts have ſuggeſted to me,
‘ concerning that part of *Optics* which
‘ is more properly *Mathematical*. As
‘ for the other Parts of that Science
‘ (which being rather *Phyſical*, do
‘ conſequently abound with plauſi-
‘ ble Conjectures, inſtead of certain
‘ Principles) there has in them ſcarce
‘ any thing occur'd to my Obſerva-
‘ tion, different from what has been
‘ already ſaid by *Kepler*, *Scheinerus*,
‘ *Deſcartes*, &c. And, methinks, I
‘ had better ſay nothing at all, than
‘ repeat that which has been ſo of-
‘ ten ſaid by others. I think it there-
‘ fore high time to take my leave
‘ of this Subject. But before I quit
‘ it for good and all, the fair and
‘ ingenuous Dealing that I owe both
‘ to You and to Truth, obliges me
‘ to acquaint you with a certain un-
‘ toward Difficulty, which ſeems di-
‘ rectly oppoſite to the Doctrine I

have been hitherto inculcating, at leaſt, admits of no Solution from it. In ſhort it is this. Before the double Convex Glaſs or Concave *Speculum* EBF, let the Point A be placed, at ſuch a Diſtance that the Rays proceeding from A, after Refraction or Reflection, be brought to Unite ſomewhere in the Ax AB. And ſuppoſe the Point of Union (*i. e.* the Image of the Point A, as hath been already ſet forth) to be Z; between which and B, the *Vertex* of the Glaſs or *Speculum*, conceive the Eye to be any where placed. The Queſtion now is, Where the Point A ought to appear. Experience ſhews that it doth not appear behind at the Point Z, and it were contrary



‘ to Nature that it ſhou’d; ſince all the Impreſſion which affects the Senſe comes from towards A. But from our Tenents it ſhou’d ſeem to follow, that it wou’d appear before the Eye at a vaſt Diſtance off, ſo great as ſhou’d in ſome Sort, ſurpaſs all ſenſible Diſtance. For ſince if we exclude all Anticipations and Prejudices, every Object appears by ſo much the farther off, by how much the Rays it ſends to the Eye are leſs Diverging. And that Object is thought to be moſt remote, from which Parallel Rays proceed unto the Eye. Reaſon wou’d make one think, that Object ſhou’d appear, at yet a greater Diſtance, which is ſeen by converging Rays. Moreover it may in general be asked concerning this Caſe, what it is that determines the apparent Place of the Point A, and maketh it to appear after a conſtant manner, ſometimes nearer, at other times farther off? To which doubt, I ſee no-

‘ thing that can be anſwer’d agree-
‘ able to the Principles we have laid
‘ down except only that the Point A
‘ ought always to appear extreamly
‘ remote. But on the contrary, we
‘ are aſſur’d by Experience that the
‘ Point A appears variouſly Diſtant,
‘ according to the different Situations
‘ of the Eye between the Points B and
‘ Z. And that it doth almoſt never
‘ (if at all) ſeem farther off, than it
‘ wou’d if it were beheld by the na-
‘ ked Eye, but on the contrary, it
‘ doth ſometimes appear much near-
‘ er. Nay, it is even certain, that
‘ by how much the Rays falling on
‘ the Eye do more Converge, by ſo
‘ much the nearer does the Object
‘ ſeem to Approach. For the Eye
‘ being placed cloſe to the Point B,
‘ the Object A appears nearly in it’s
‘ own natural Place, if the Point B
‘ is taken in the Glaſs, or at the ſame
‘ Diſtance, if in the *Speculum*. The
‘ Eye being brought back to O, the
‘ Object ſeems to draw near. And

being come to P it beholds it ſtill nearer. And ſo on by little and little, till at length the Eye being placed ſomewhere, ſuppoſe at Q, the Object appearing extreamly near, begins to vaniſh into meer Confuſion. All which doth ſeem Repugnant to our Principles, at leaſt, not rightly to agree with them. Nor is our Tenent alone ſtruck at by this Experiment, but likewiſe all others that ever came to my Knowledge are, every whit as much, endanger'd by it. The ancient one eſpecially (which is moſt commonly receiv'd, and comes neareſt to mine) ſeems to be ſo effectually overthrown thereby, that the moſt learned *Tacquet* has been forc'd to reject that Principle, as falſe and uncertain, on which alone he had built almoſt his whole *Catoptrics*, and conſequently by taking away the Foundation, hath himſelf pulled down the Superſtructure he had raiſed on it. Which neverthe leſs,

‘ I do not believe he wou’d have done, had he but conſider’d the whole matter more throughly, and examin’d the Difficulty to the bottom. But as for me, neither this, nor any other Difficulty ſhall have ſo great an Influence on me, as to make me renounce that which I know to be manifeſtly agreeable to Reaſon. Eſpecially when, as it here falls out, the Difficulty is founded in the peculiar Nature of a certain odd and particular Caſe. For in the preſent Caſe ſomething peculiar lies hid, which being involv’d in the Subtilty of Nature will, perhaps, hardly be diſcover’d till ſuch Time, as the manner of *Viſion* is more perfectly made known. Concerning which, I muſt own, I have hitherto been able to find out nothing that has the leaſt ſhew of *Probability*, not to mention *Certainty*. I ſhall therefore, leave this Knot to be untied by you, wiſhing you may have better Succeſs in it than I have had.

XXX. *This Caſe contradicts a receiv'd Principle in* Catoptrics.

THE ancient and receiv'd Principle which Dr. *Barrow* here mentions, as the main Foundation of *Tacquet's Catoptrics*, is that, *every viſible Point ſeen by Reflexion from a* Speculum, *ſhall appear placed at the Interſection of the reflected Ray, and the Perpendicular of Incidence.* Which Interſection in the preſent Caſe, happening to be behind the Eye, it greatly ſhakes the Authority of that Principle, whereon the aforemention'd Author proceeds throughout his whole *Catoptrics*, in determining the apparent Place of Objects ſeen by Reflexion from any kind of *Speculum*.

XXXI. *It is ſhewn to agree with the Principles we have laid down.*

LET us now ſee how this *Phænomenon* agrees with our Tenents. The Eye the nearer it is placed to the Point B in the above Figures, the more diſtinct is the Appearance of the Object ; but as it recedes to O, the Appearance grows more Confuſed ; and at P it ſees the Object yet more Confuſed ; and ſo on till the Eye being brought back to Z ſees the Object in the greateſt Confuſion of all. Wherefore by *Sect.* XXI. the Object ſhou'd ſeem to approach the Eye gradually, as it recedes from the Point B, *viz.* at O it ſhou'd (in conſequence of the Principle I have laid down in the aforeſaid *Section*) ſeem nearer than it did at B, and at P nearer than at O, and at Q nearer than at P ; and ſo on, till it quite vaniſhes at Z. Which is the very matter of Fact, as any one that pleaſes may eaſily ſatisfie himſelf by Experiment.

XXXII. *This* Phænomenon *Illuſtrated.*

THIS Caſe is much the ſame, as if we ſhou'd ſuppoſe an *Engliſh-man* to meet a Foreigner, who uſed the ſame Words with the *Engliſh*, but in a direct contrary Signification. The *Engliſh-man* wou'd not fail to make a wrong Judgment, of the *Ideas* annexed to thoſe Sounds, in the Mind of him that uſed them. Juſt ſo, in the preſent Caſe the Object ſpeaks (if I may ſo ſay) with Words that the Eye is well acquainted with, *viz.* Confuſions of Appearance ; but whereas heretofore the greater Confuſions were always wont to ſignifie nearer Diſtances, they have in this Caſe a direct, contrary Signification, being connected with the greater Diſtances. Whence it follows, that the Eye muſt unavoidably be miſtaken, ſince it will take the Confuſions in the Senſe it has been uſed to, which is directly oppoſed to the True.

XXXIII. *It confirms the Truth of the Principle whereby it is explained.*

This *Phænomenon* as it entirely ſubverts the Opinion of thoſe, who will have us Judge of Diſtance by Lines and Angles, on which Suppoſition it is altogether inexplicable, ſo it ſeems to me no ſmall Confirmation, of the Truth of that Principle whereby it is explain'd.

But in order to a more full Explication of this Point, and to ſhew how far the *Hypotheſis* of the Mind's judging by the various Divergency of Rays, may be of uſe in determining the apparent Place of an Object, it will be neceſſary to premiſe ſome few Things, which are already well known to thoſe who have any Skill in *Dioptrics*.

XXXIV. *Viſion when Diſtinct, and when Confus'd.*

Firſt, ANY radiating Point is then diſtinctly ſeen when the Rays proceeding from it are, by the refractive Power of the Cryſtalline, accurately reunited in the *Retina*, or Fund of the Eye. But if they are reunited, either before they arrive at the *Retina*, or after they have paſt it, then there is confuſed Viſion.

XXXV. *The different Effects of Parallel, Diverging and Converging Rays.*

Secondly, SUPPOSE in the adjacent Figures NP repreſent an Eye duly framed, and retaining its natural Figure. In *Fig*. 1. the Rays falling nearly Parallel on the Eye, are by the Cryſtalline AB refracted, ſo as their *Focus*, or Point of Union F falls exactly on the *Retina*. But if

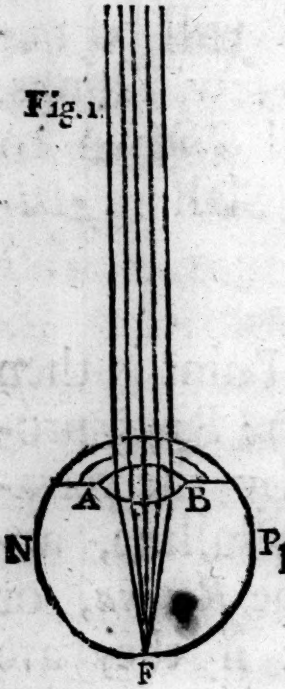


Fig. 1.

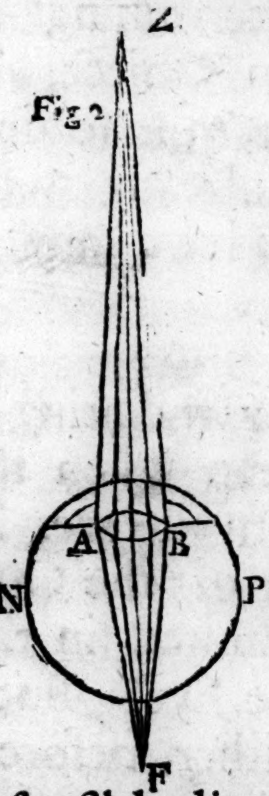


Fig. 2.

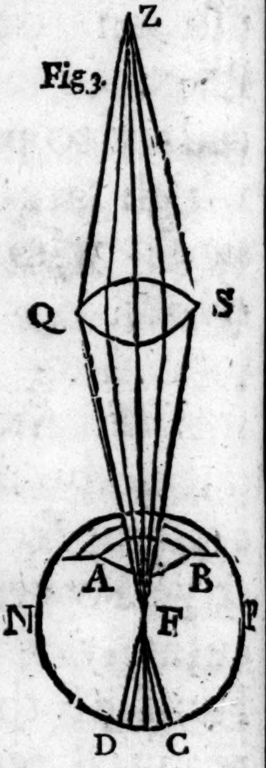


Fig. 3.

the Rays fall ſenſibly diverging on the Eye, as in *Fig*. 2. then their *Focus* falls beyond the *Retina*: Or if the Rays are made to converge by the *Lens* QS, before they come at the Eye, as in *Fig*. 3. their *Focus* F will fall before the *Retina*. In which two laſt

Caſes, 'tis evident from the foregoing *Section*, that the Appearance of the Point Z is confuſed. And by how much the greater is the Convergency, or Divergency of the Rays falling on the *Pupil*, by ſo much the farther will the Point of their reunion be from the *Retina*, either before or behind it, and conſequently the Point Z will appear, by ſo much, the more Confuſed. And this by the Bye, may ſhew us the difference between Confuſed, and Faint Viſion. Confuſed Viſion is, when the Rays proceeding from each diſtinct Point of the Object, are not accurately recollected in one correſponding Point on the *Retina*; but take up ſome Space thereon. So that Rays from different Points become mix'd, and confuſed together. This is oppoſed to diſtinct Viſion, and attends near Objects. Faint Viſion is, when by reaſon of the Diſtance of the Object, or groſneſs of the interjacent

Medium, few Rays arrive from the Object to the Eye. This is oppos'd to vigorous, or clear Viſion, and attends remote Objects. But to return.

XXXVI. *How Converging, and Diverging Rays come to ſuggeſt the ſame Diſtance.*

The Eye, or (to ſpeak truly) the Mind perceiving only the Confuſion it ſelf, without ever conſidering the Cauſe from which it proceeds, doth conſtantly annex the ſame Degree of Diſtance, to the ſame Degree of Confuſion. Whether that Confuſion be occaſion'd by Converging, or by Diverging Rays, it matters not. Whence it follows, that the Eye viewing the Object Z thro' the Glaſs QS (which by Refraction cauſeth the Rays ZQ, ZS, &c. to converge) ſhou'd judge it to be at ſuch a Nearneſs, at which if it were placed, it wou'd radiate on the Eye with Rays diverging to that Degree, as wou'd produce the ſame Confuſion, which is now produced by Converging

Rays, *i.e.* wou'd cover a Portion of the *Retina* equal to DC. *vid. Fig.* 3. *Sup.* But then this muſt be underſtood (to uſe Dr. *Barrow*'s Phraſe) *Secluſis prænotionibus & præjudiciis*, In caſe, we abſtract from all other Circumſtances of Viſion, ſuch as the Figure, Size, Faintneſs, *&c.* of the viſible Objects; all which do ordinarily concur to form our *Idea* of Diſtance; the Mind having, by frequent Experience, obſerved their ſeveral Sorts or Degrees, to be connected with various Diſtances.

XXXVII. *A Perſon extream Purblind wou'd judge aright in the foremention'd Caſe.*

It plainly follows from what has been ſaid, that a Perſon perfectly Purblind (*i. e.* that cou'd not ſee an Object diſtinctly, but when placed cloſe to his Eye) wou'd not make the ſame wrong Judgment that others do, in the foremention'd Caſe. For, to him, greater Confuſions conſtantly ſuggeſting greater Diſtances, he muſt, as he recedes from the Glaſs, and the Object grows more Confus'd, judge it to be at a farther Diſtance, contrary to what they do, who have had the Perception of the Objects growing more Confuſed, connected with the *Idea* of Approach.

XXXVIII. *Lines and Angles why uſeful in* Optics.

HENCE alſo it doth appear, there may be good uſe of computation by Lines and Angles in *Optics*; not, that the Mind judges of Diſtance immediately by them, but becauſe it judges by ſomewhat which is connected with them, and to the determination whereof, they may be ſubſervient. Thus the Mind judging of the Diſtance of an Object, by the Confuſedneſs of it's Appearance; and this Confuſedneſs being greater or leſſer to the naked Eye, according as the Object is ſeen by Rays more, or leſs Diverging; it follows, that a Man may make uſe of the Divergency of the Rays, in computing the apparent Diſtance, tho' not for it's own ſake, yet on account of the Confuſion with which it is connected.

ed. But, ſo it is, the Confuſion it ſelf is entirely neglected by *Mathematicians*, as having no neceſſary relation with Diſtance, ſuch as the greater or leſſer Angles of Divergency are conceiv'd to have. And theſe (eſpecially for that they fall under *Mathematical* Computation) are alone regarded, in determining the apparent Places of Objects, as tho' they were the ſole and immediate Cauſe of the Judgments the Mind makes of Diſtance. Whereas, in Truth, they ſhou'd not at all be regarded in themſelves, or any otherwiſe, than as they are ſuppoſed to be the Cauſe of Confuſed Viſion.

XXXIX. *The not underſtanding this, a cauſe of Miſtake.*

THE not conſidering of this has been a fundamental and perplexing Overſight. For Proof whereof, we need go no farther than the Caſe before us. It having been obſerved, that the moſt Diverging Rays brought into the Mind the *Idea* of neareſt Diſtance, and that ſtill, as the Divergency decreas'd, the Diſtance increas'd; and it being thought, the connexion between the various Degrees of Divergency, and Diſtance, was immediate; this naturally leads one to conclude, from an ill grounded Analogy, that Converging Rays ſhall make an Object appear at an immenſe Diſtance: And that, as the Convergency increaſes, the Diſtance (if it were poſſible) ſhou'd do ſo likewiſe. That this was the Cauſe of Dr. *Barrow*'s Miſtake, is evident from his own Words which we have Quoted. Whereas had the learned Doctor obſerv'd, that Diverging and Converging Rays, how oppoſite ſoever they may ſeem, do nevertheleſs agree in producing the ſame effect, *viz. Confuſedneſs of Viſion*, greater Degrees whereof are produced indifferently, either as the Divergency, or Convergency of the Rays increaſeth. And that it is by this effect, which is the ſame in both, that either the Divergency, or Convergency

vergency is perceived by the Eye. I ſay, had he but conſider'd this, 'tis certain he would have made a quite contrary Judgment, and rightly concluded, that thoſe Rays which fall on the Eye with greater degrees of Convergency ſhou'd make the Object from whence they proceed, appear by ſo much the nearer. But 'tis plain, it was impoſſible for any Man to attain to a right Notion of this Matter, ſo long as he had regard only to Lines and Angles; and did not apprehend the true Nature of *Viſion*, and how far it was of *Mathematical* Conſideration.

XL. *A Query propos'd by* Mr. Molyneux *in his* Dioptrics, *conſider'd.*

BEFORE we diſmiſs this Subject, 'tis fit we take Notice of a Query relating thereto, propoſed by the Ingenious Mr. *Molyneux*, in his Treatiſe of *Dioptrics*, *Par.* 1. *Prop.* 31. *Sect.* 9. where ſpeaking of the Difficulty we have been explaining, he has theſe Words, 'And ſo he (*i. e.* Dr. *Barrow*) leaves 'this Difficulty to the Solution of 'Others, which I (after ſo great 'an Example) ſhall do likewiſe; 'but with the Reſolution of the 'ſame admirable Author of not 'quitting the evident Doctrine 'which we have before laid down, 'for determining the *Locus Objecti*, 'on account of being Preſs'd by 'one Difficulty, which ſeems in'explicable till a more intimate 'Knowledge of the Viſive Facul'ty be obtain'd by Mortals. In 'the mean time, I propoſe it to 'the Conſideration of the Ingeni'ous, Whether the *Locus Apparens* 'of an Object placed as in this '9th *Section*, be not as much be'fore the Eye, as the diſtinct Baſe 'is behind the Eye? To which Query we may venture to anſwer in the Negative. For in the preſent Caſe, the Rule for determining the Diſtance of the diſtinct Baſe, or reſpective *Focus* from the

Glaſs, is this. *As the difference between the Diſtance of the* Object *and* Focus *: is to the* Focus *or* Focal Length *:: So the Diſtance of the* Object *from the Glaſs : to the Diſtance of the reſpective* Focus *or Diſtinct Baſe from the Glaſs. Vid.* Molyneux *Dioptr. Par.* 1. *Prop.* 5. Let us now ſuppoſe the Object to be placed at the Diſtance of the Focal Length, and one half of the Focal Length from the Glaſs, and the Eye cloſe to the Glaſs. Hence it will follow by the Rule, that the Diſtance of the Diſtinct Baſe behind the Eye is double the true Diſtance of the Object before the Eye. If therefore Mr. *Molyneux*'s Conjecture held good, it wou'd follow, that the Eye ſhou'd ſee the Object, twice as far off as it really is. And in other Caſes, at three or four times it's due Diſtance or more. But this manifeſtly contradicts Experience; the Object never appearing, at fartheſt, beyond its due Diſtance. What ever therefore is built on this Suppoſition (*vid. Corol.* 1. *Prop.* 57. *ibid.*) comes to the Ground along with it.

XLI. *One Born Blind wou'd not at firſt have any* Idea *of Diſtance by Sight.*

FROM what hath been premis'd, it is a manifeſt Conſequence, that a Man Born Blind, being made to ſee wou'd at firſt, have no *Idea* of Diſtance by Sight. The Sun and Stars, the remoteſt Objects as well as the nearer wou'd all ſeem to be in his Eye, or rather in his Mind. The Objects intromitted by Sight, wou'd ſeem to him (as in truth they are) no other than a new Set of Thoughts or Senſations, each whereof is as near to him, as the Perceptions of Pain or Pleaſure, or the moſt inward Paſſions of his Soul. For our judging Objects perceiv'd by Sight to be at any Diſtance, or without the Mind, is (*vid. Sect.* XXVIII.) intirely the effect of Experience, which one in thoſe Circumſtances cou'd not yet have attained to.

XLII. *This not agreeable to the common Principles.*

It is indeed otherwiſe upon the common Suppoſition, that Men judge of Diſtance by the Angle of the *Optic Axes*, juſt as one in the Dark, or a Blind-Man by the Angle comprehended by two Sticks, one whereof he held in each Hand. For if this were true, it wou'd follow that one Blind from his Birth, being made to See, ſhou'd ſtand in need of no new Experience, in order to perceive Diſtance by Sight. But that this is Falſe, has I think, been ſufficiently demonſtrated.

XLIII. *The proper* Objects *of Sight, not without the Mind, nor the Images of any thing without the Mind.*

And perhaps, upon a ſtrict Inquiry we ſhall not find, that even thoſe, who from their Birth have grown up in a continu'd Habit of Seeing, are irrecoverably prejudiced on the other ſide, *viz.* in thinking what they See to be at a Diſtance from them. For at this time it ſeems agreed on all Hands, by thoſe who have had any thoughts of that Matter, that Colours, which are the proper and immediate Object of Sight, are not without the Mind. But then ſay you, by Sight we have alſo the *Ideas* of Extenſion, and Figure, and Motion; all which may well be thought without, and at ſome Diſtance from the Mind, tho' Colour ſhou'd not. In anſwer to this, I appeal to any Man's Experience, whether the viſible Extenſion of any Object do not appear as near to him, as the Colour of that Object; Nay, whether they do not both ſeem to be in the very ſame Place. Is not the Extenſion we ſee Colour'd, and is it poſſible for us, ſo much as in Thought, to ſeparate and abſtract Colour from Extenſion? Now, where the Extenſion is, there ſurely is the Figure, and there the Motion too. I ſpeak of thoſe which are perceiv'd by Sight.

XLIV. *This more fully explain'd.*

But for a fuller Explication of this Point, and to ſhew that the immediate Objects of Sight are not ſo much as the *Ideas* or Reſemblances of things placed at a Diſtance, 'tis requiſite we look nearer into the Matter, and carefully obſerve what is meant in common Diſcourſe, when one ſays, that which he ſees is at a Diſtance from him. Suppoſe, for Example, That looking at the Moon I ſhou'd ſay, it were Fifty or Sixty Semidiameters of the Earth diſtant from me. Let us ſee what Moon this is ſpoken of. 'Tis plain it cannot be the viſible Moon, or any thing like the viſible Moon, or that which I ſee, which is only a round, luminous Plain, of about Thirty viſible Points in Diameter. For in caſe I am carry'd, from the place where I ſtand directly towards the Moon; 'tis manifeſt the Object varies, ſtill as I go on; and by the time that I am advanced Fifty or Sixty Semidiameters of the Earth, I ſhall be ſo far from being near a ſmall, round, luminous Flat, that I ſhall perceive nothing like it; this Object having long ſince diſappear'd, and if I wou'd recover it, it muſt be by going back to the Earth from whence I ſet out. Again, Suppoſe I perceive by Sight the faint and obſcure *Idea* of ſomething, which I doubt whether it be a Man, or a Tree, or a Tower; but judge it to be at the Diſtance of about a Mile. 'Tis plain I cannot mean, that what I ſee is a Mile off, or that it is the Image or Likeneſs of any thing which is a Mile off. Since that every Step I take towards it, the Appearance alters, and from being Obſcure, Small, and Faint grows, Clear, Large, and Vigorous. And when I come to the Mile's end, that which I ſaw firſt is quite loſt, neither do I find any thing in the likeneſs of it.

XLV. *In what Senſe we muſt be underſtood to ſee Diſtance and external Things.*

In theſe, and the like Inſtances, the truth of the Matter, I find, ſtands thus. Having of a long time, experienced certain *Ideas*, perceivable by Touch, as Diſtance, Tangible Figure, and Solidity to have been connected with certain *Ideas* of Sight, I do upon perceiving theſe *Ideas* of Sight, forthwith conclude what Tangible *Ideas* are, by the wonted, ordinary courſe of Nature like to follow. Looking at an Object I perceive a certain Viſible Figure, and Colour with ſome degree of Faintneſs and other Circumſtances; which, from what I have formerly obſerv'd, determin me to think, that if I advance forward ſo many Paces, Miles, *&c.* I ſhall be affected with ſuch, and ſuch *Ideas* of Touch. So that in truth, and ſtrictneſs of Speech, I neither ſee Diſtance it ſelf, nor any thing that I take to be at a Diſtance. I ſay, neither Diſtance, nor things placed at a diſtance are themſelves, or their *Ideas*, truly perceiv'd by Sight. This I am perſwaded of, as to what concerns my ſelf. And I believe whoever will look narrowly into his own Thoughts, and examin what he means by ſaying, he ſees this, or that thing at a Diſtance, will agree with me that, what he ſees only ſuggeſts to his Underſtanding, that after having paſſed a certain Diſtance, to be meaſur'd by the Motion of his Body, which is perceivable by Touch, he ſhall come to perceive ſuch, and ſuch Tangible *Ideas* which have been uſually connected with ſuch and ſuch Viſible *Ideas*. But that one might be deceived by theſe ſuggeſtions of Senſe, and that there is no neceſſary Connexion, between Viſible, and Tangible *Ideas* ſuggeſted by them, we need go no farther than the next Looking-Glaſs or Picture,

cture, to be convinced. Note, that when I ſpeak of Tangible *Ideas*, I take the Word *Idea* for any the immediate Object of Senſe, or Underſtanding, in which large Signification it is commonly uſed by the Moderns.

XLVI. *Diſtance and things placed at a Diſtance, not otherwiſe perceived by the Eye than by the Ear.*

FROM what we have ſhewn it is a manifeſt Conſequence, that the *Ideas* of Space, Outneſs, and things placed at a diſtance are not ſtrictly ſpeaking, the Object of Sight. They are no otherwiſe perceived by the Eye, then by the Ear. Sitting in my Study I hear a Coach drive along the Streets. I look through the Caſement and ſee it. I walk out and enter into it. Thus, common Speech wou'd incline one to think, I heard, ſaw, and touch'd the ſame Thing, *viz.* the Coach. It is, nevertheleſs, certain, the *Ideas* intromitted by each Senſe are widely different, and diſtinct from each other ; but having been obſerved conſtantly to go together, they are ſpoken of as one and the ſame thing. By the variation of the Noiſe, I perceive the different Diſtances of the Coach, and know that it approaches before I look out. Thus by the Ear I perceive Diſtance, juſt after the ſame manner, as I do by the Eye.

XLVII. *The* Ideas *of Sight more apt to be confounded with the* Ideas *of Touch than thoſe of Hearing are.*

I do not, nevertheleſs, ſay I hear Diſtance, in like manner as I ſay that I ſee it, the *Ideas* perceiv'd by Hearing not being ſo apt to be confounded with the *Ideas* of Touch, as thoſe of Sight are. So likewiſe, a Man is eaſily convinced that Bodies, and external Things are not properly the Object of Hearing, but only Sounds, by the Mediation whereof the *Idea* of this or that Body, or Diſtance is ſuggeſted to his Thoughts. But then one is with more difficulty, brought to diſcern the difference there is, betwixt the *Ideas* of Sight and Touch: Tho' it be certain, a Man no more Sees and Feels the ſame

Thing, than he Hears and Feels the ſame Thing.

XLVIII. *How this comes to paſs.*

One Reaſon of which ſeems to be this. It is thought a great Abſurdity to imagine that one, and the ſame thing, ſhou'd have any more than one Extenſion, and one Figure. But the Extenſion and Figure of a Body, being let into the Mind two ways, and that indifferently, either by Sight, or Touch, it ſeems to follow that we ſee the ſame Extenſion, and the ſame Figure which we Feel.

XLIX. *Strictly ſpeaking, we never ſee and feel the ſame thing.*

But if we take a cloſe and accurate View of the Matter, it muſt be acknowledg'd, that we never See and Feel one and the ſame thing. That which is Seen is one thing, and that which is Felt is another. If the Viſible Figure and Extenſion be not the ſame, with the Tangible Figure and Extenſion, we are not to infer, that one and the ſame thing has divers Extenſions. The true Conſequence is, that *the Objects of* Sight *and* Touch *are two diſtinct things.* It may perhaps, require ſome Thought, rightly to conceive this Diſtinction. And the difficulty ſeems not a little increas'd, becauſe the Combination of Viſible *Ideas* hath conſtantly the ſame Name, as the Combination of Tangible *Ideas* wherewith it is connected. Which does of neceſſity ariſe from the uſe, and end of Language.

L. Objects *of* Sight *twofold Mediate and Immediate.*

In order therefore to treat accurately, and unconfuſedly of *Viſion*, we muſt bear in Mind, that there are two ſorts of Objects apprehended by the Eye: The one, primarily and immediately, the other, ſecondarily and by intervention of the former. Thoſe of the firſt ſort neither are, nor appear to be without the Mind, or at any diſtance off. They may, indeed, grow Greater, er, or Smaller, more Confuſed, or more Clear, or more Faint. But, they do not, cannot Approach, or even ſeem to Approach, or Recede from us. Whenever we ſay an Object is at a Diſtance, whenever we ſay, it draws near, or goes farther off; we muſt always mean t of the latter ſort, which properly belong to the *Touch*, and are not ſo truly perceived, as ſuggeſted, by the Eye, in like manner as Thoughts by the Ear.

II.
Theſe hard to ſeparate, in our Thoughts.

No ſooner do we hear the Words of a familiar Language pronounced in our Ears, but the *Ideas* correſponding thereto preſent themſelves to our Minds. In the very ſame inſtant, the Sound and the Meaning enter the Underſtanding. So cloſely are they United, that 'tis not in our Power to keep out the one, except we exclude the other alſo. We even act in all reſpects, as tho' we heard the very

Thoughts themſelves. So likewiſe, the ſecondary Objects, or thoſe which are only ſuggeſted by Sight, do often more ſtrongly affect us, and are more regarded than the proper Objects of that Senſe; along with which they enter into the Mind, and with which they have a far more ſtrict and near Connexion, than *Ideas* have with Words. Hence it is, we find it ſo difficult to diſcriminate, between the immediate and mediate Objects of Sight, and are ſo prone to attribute to the former, what belongs only to the latter. They are, as it were, moſt cloſely twiſted, blended, and incorporated together. And the Prejudice is confirmed, and riveted in our Thoughts, by a long tract of Time, by the uſe of Language, and want of Reflexion. However, I doubt not, but any one that ſhall attentively conſider what we have already ſaid, and ſhall ſay upon this Subject before we have done, (eſpecially if he purſue it in his own Thoughts) may be able to deliver himſelf from that Prejudice. Sure I am, 'tis worth ſome Attention, to whoever wou'd underſtand the true nature of *Viſion*.

LII. *The received Accounts of our perceiving Magnitude by Sight, falſe*

I HAVE now done with Diſtance, and proceed to ſhew, how it is, that we perceive by Sight, the Magnitude of Objects. It is the Opinion of ſome, that we do it by Angles, or by Angles in Conjunction with Diſtance. But neither Angles, nor Diſtance being perceivable by Sight: And the things we ſee being, in truth, at no Diſtance from us; it follows that as we have demonſtrated Lines and Angles not to be the *Medium*, the Mind makes uſe of in apprehending the Apparent Place, ſo neither are they, the *Medium* whereby it apprehends the Apparent Magnitude of Objects.

LIII. *Magnitude perceiv'd as immediately, as Diſtance.*

It is well known that the ſame Extenſion, at a near Diſtance, ſhall ſubtend a greater Angle, and at a farther Diſtance, a leſſer Angle. And by this Principle (we are told) the Mind eſtimates the Magnitude of an Object, comparing the Angle under which it is ſeen, with its Diſtance, and thence infering the Magnitude thereof. What inclines Men to this Miſtake (beſide the Humour of making one ſee by *Geometry*) is, that the ſame Perceptions or *Ideas* which ſuggeſt Diſtance, do alſo ſuggeſt Magnitude. But if we examin it, we ſhall find they ſuggeſt the latter, as immediately as the former. I ſay, they do not firſt ſuggeſt Diſtance, and then leave it to the Judgment to uſe that as a *Medium*, whereby to collect the Magnitude; but they have as cloſe, and immediate a Connexion with the Magnitude, as with the Diſtance; and ſuggeſt Magnitude as independently of Diſtance, as they do Diſtance independently of Magnitude. All which will be evident, to whoever conſiders what has been already ſaid, and what follows.

LIV. *Two kinds of ſenſible Extenſion, neither of which is infinitely Diviſible.*

It has been ſhewn, there are two ſorts of Objects apprehended by Sight; each whereof hath its diſtinct Magnitude, or Extenſion. The one, properly Tangible, *i. e.* to be perceiv'd and meaſur'd by Touch, and not immediately falling under the Senſe of Seeing. The other, properly and immediately Viſible, by Mediation of which, the former is brought in View. Each of theſe Magnitudes are greater or leſſer, according as they contain in them more or fewer Points; they being made up of Points or *Minimums.* For, whatever may be ſaid of Extenſion in *Abſtract*, it is certain ſenſible Extenſion is not infinitely Diviſible. There is a *Minimum Tangible*, and a *Minimum Viſibile*, beyond which Senſe cannot perceive. This, every ones Experience will inform him.

LV. *The Tangible Magnitude of an* Object *ſteddy, the Viſible not.*

THE Magnitude of the Object which exiſts without the Mind, and is at a Diſtance, continues always invariably the ſame. But the Viſible Object ſtill changing as you approach to, or recede from the Tangible Object, it hath no fixed and determinate Greatneſs. Whenever therefore, we ſpeak of the Magnitude of any thing, for Inſtance a *Tree* or a *Houſe*, we muſt mean the Tangible Magnitude, otherwiſe there can be nothing ſteddy, and free from Ambiguity ſpoken of it. Now, tho' the Tangible and Viſible Magnitude do in truth, belong to two diſtinct Objects : I ſhall nevertheleſs (eſpecially ſince thoſe Objects are called by the ſame Name, and are obſerv'd to coexiſt) to avoid tediouſneſs and ſingularity of Speech, ſometimes ſpeak of them, as belonging to one and the ſame thing.

LVI. *By what means, Tangible Magnitude is perceived by Sight.*

Now in order to diſcover by what means, the Magnitude of Tangible Objects is perceived by Sight; I need only reflect on what Paſſes in my own Mind. And obſerve what thoſe things be, which introduce the *Ideas* of *greater* or *leſſer* into my Thoughts, when I look on any Object. And theſe I find to be, Firſt, the Magnitude or Extenſion of the Viſible Object, which being immediately perceived by Sight, is connected with that other which is Tangible, and placed at a Diſtance. Secondly, The Confuſion or Diſtinctneſs. And Thirdly, The Vigorouſneſs or Faintneſs of the aforeſaid Viſible Appearance. *Cæteris paribus*, by how much the greater or leſſer, the Viſible Object is, by ſo much the greater or leſſer, do I conclude the Tangible Object to be. But, be the *Idea* immediately perceived by Sight never ſo large, yet if it be withal Confuſed,

fuſed, I judge the Magnitude of the thing to be but ſmall. If it be Diſtinct and Clear, I judge it greater. And if it be Faint, I apprehend it to be yet greater. What is here meant, by Confuſion and Faintneſs, has been Explain'd in *Sect.* XXXV.

LVII. *This farther enlarged on.*

MOREOVER, the Judgments we make of Greatneſs do in like manner as thoſe of Diſtance, depend on the Diſpoſition of the Eye, alſo on the Figure, Number of intermediate Objects and other Circumſtances that have been obſerv'd to attend great, or ſmall Tangible Magnitudes. Thus, for Inſtance, The very ſame Quantity of Viſible Extenſion, which in the Figure of a Tower, doth ſuggeſt the *Idea* of great Magnitude, ſhall, in the Figure of a Man ſuggeſt the *Idea* of much ſmaller Magnitude. That this is owing to the Experience we have had, of the uſual Bigneſs of

a

a Tower and a Man, no one, I ſuppoſe, need be told.

LVIII. *No neceſſary Connexion between, Confuſion or Faintneſs of appearance, and ſmall or great Magnitude.*

It is alſo evident, that Confuſion, Faintneſs, *&c.* have no more a neceſſary Connexion with little or great Magnitude, than they have with little or great Diſtance. As they ſuggeſt the latter, ſo they ſuggeſt the former to our Minds. And by Conſequence, if it were not for *Experience*, we ſhou'd no more judge a faint or confuſed Appearance to de connected, with great or little Magnitude, than we ſhou'd that it was connected with great or little Diſtance.

LIX. *The Tangible Magnitude of an* Object, *more heeded than the Viſible; and why.*

Nor will it be found, that great or ſmall Viſible Magnitude hath any neceſſary Relation to great or ſmall Tangible Magnitude: So that the one may certainly, and infallibly be infer'd from the other. But, before we come to the Proof of this, 'tis fit we conſider the difference there is, betwixt the Extenſion and Figure which is the proper Object of *Touch*, and that other which is termed *Viſible*; and how the former is principally, tho' not immediately, taken notice of, when we look at any Object. This has been before mention'd, bu we ſhall here enquire into th Cauſe thereof. We regard the Objects that environ us, in proportion as they are adapted to benefit, or injure our own Bodies and thereby, produce in our *Mind* the Senſations of Pleaſure, or Pai Now Bodies operating on our Organs, by an immediate Application: And the Hurt and Advantag ariſing there-from, depending altogether on the Tangible, and no at all on the Viſible, Qualities o any Object. This is a plain Reaſon, why thoſe ſhou'd be regarded by us much more then the And for this End, chiefly, the *Viſive Senſe* ſeems to have been beſtowe ſtowed on Animals, *viz.* that by the Perception of Viſible *Ideas* (which in themſelves are not capable of affecting, or any wiſe altering the Frame of their Bodies) they may be able to foreſee (from the Experience they have had,what Tangible *Ideas* are connected with ſuch, and ſuch Viſible *Ideas*) the Damage or Benefit which is like to enſue, upon the Application of their own Bodies to this, or that Body which is at a Diſtance. Which Foreſight, how neceſſary it is to the preſervation of an Animal, every ones Experience can inform him. Hence it is, that when we look at an Object, the Tangible Figure and Extenſion thereof are principally attended to; whilſt there is ſmall heed taken of the Viſible Figure and Magnitude, which, tho' more immediately perceiv'd, do leſs ſenſibly affect us, and are not fitted to produce any Alteration in our Bodies.

LX. *An Inſtance of this.* THAT the Matter of Fact is true, will be evident to any one, who conſiders that a Man placed at Ten Foot Diſtance, is thought as great, as if he were placed at the Diſtance only of Five Foot; which is true, not with Relation to the Viſible, but Tangible greatneſs of the Object. The Viſible Magnitude being far greater, at one Station, than it is at the other.

LXI. *Men do not Meaſure by Viſible Feet or Inches.* INCHES, Feet, *&c.* are ſettled, ſtated Lengths, whereby we meaſure Objects, and eſtimate their Magnitude, we ſay, for Example, an Object appears to be Six Inches, or Six Foot long. Now, that this cannot be meant of Viſible Inches, *&c.* is evident, becauſe a Viſible Inch is it ſelf no conſtant, determinate Magnitude, and cannot, therefore, ſerve to mark out, and determin the Magnitude of any other

ther thing. Take an Inch mark'd upon a Ruler; view it, ſucceſſively, at the diſtance of Half a Foot, a Foot, a Foot and a Half, *&c.* from the Eye; at each of which, and at all the intermediate Diſtances, the Inch ſhall have a different Viſible Extenſion, *i. e.* there ſhall be more or fewer Points diſcerned in it. Now I ask which of all theſe various Extenſions, is that Stated, determinate one, that is agreed on, for a common Meaſure of other Magnitudes? No reaſon can be aſſign'd, why we ſhou'd pitch on one, more than another. And except there be ſome invariable, determinate Extenſion fixed on, to be Mark'd by the Word *Inch*, 'tis plain, it can be uſed to little Purpoſe; and to ſay, a Thing contains this or that Number of *Inches*, ſhall imply no more than that it is extended, without bringing any particular *Idea* of that Extenſion into the Mind. Farther, an

Inch and a Foot, from different Diſtances, ſhall both exhibit the ſame Viſible Magnitude, and yet, at the ſame time, you ſhall ſay, that one ſeems ſeveral times greater than the other. From all which it is manifeſt, that the Judgments we make of the Magnitude of Objects by Sight, are altogether in reference to their Tangible Extenſion. Whenever we ſay an Object is Great, or Small, of this or that determinate Meaſure, I ſay, it muſt be meant of the Tangible, and not the Viſible Extenſion, which, tho' immediately perceiv'd, is nevertheleſs little taken Notice of.

LXII. *No neceſſary Conexion between Viſible and Tangible Extenſion*

Now, that there is no neceſſary Connexion, between theſe two Diſtinct Extenſions is evident from hence. Becauſe our Eyes might have been framed in ſuch a manner, as to be able to ſee nothing but what were leſs than the *Minimum Tangibile*. In which Caſe, it's not impoſſible we might have perceived all the Immediate Objects of Sight, the very ſame that we do now. But unto thoſe Viſible Appearances, there wou'd not be Connected thoſe different Tangible Magnitudes, that are now. Which ſhews, the Judgments we make of the Magnitude, of Things placed at a Diſtance, from the various Greatneſs of the Immediate Objects of Sight, do not ariſe from any Eſſential or Neceſſary, but only a Cuſtomary Tye, which has been obſerv'd betwixt them.

LXIII. *Greater Viſible Magnitude might ſignifie Leſſer Tangible Magnitude*

MOREOVER, it is not only certain, that any *Idea* of Sight might not have been Connected, with this or that *Idea* of Touch, we now obſerve to accompany it: But alſo, that the greater Viſible Magnitudes might have been Connected with, and Introduced into our Minds, leſſer Tangible Magnitudes, and *Vice Verſa*. Nay, that it often is ſo, we have daily Experience; that Object which makes a ſtrong and large Appearance, not ſeeming near ſo great, as another the Viſible Magnitude whereof is much leſs, but more faint.

LXIV. *The Judgments we make of Magnitude depend altogether on Experience.*

From which, and from *Sect.* LVII, and LVIII, it is manifeſt, that as we do not perceive the Magnitude of Objects immediately by Sight, ſo neither do we perceive them, by the Mediation of any thing which has a neceſſary Connexion with them. Thoſe *Ideas* that now ſuggeſt unto us, the various Magnitudes of External Objects, before we touch them, might poſſibly have ſuggeſted no ſuch thing: Or they might have ſignified them, in a direct, contrary manner, ſo that the very ſame *Ideas*, on the Perception whereof we judge an Object to be Small, might as well have ſerv'd to make us conclude it Great. Thoſe *Ideas* being in their own Nature, equally fitted to bring into our Minds the *Idea* of Small, or Great, or no Size at all of outward Objects. Juſt as the Words of any Language are in their own Nature, indifferent to ſignifie this, or that thing, or nothing at all.

LXV. *Diſtance and Magnitude ſeen as Shame or Anger.*

As we ſee Diſtance, ſo we ſee Magnitude. And we ſee both, in the ſame way that we ſee Shame or Anger, in the Looks of a Man. Thoſe Paſſions are themſelves Inviſible, they are nevertheleſs let in by the Eye along with Colours, and alterations of Countenance, which are the immediate Object of *Viſion*: And which ſignifie them for no other Reaſon, than barely becauſe they have been obſerv'd to accompany them. Without which Experience, we ſhou'd no more have taken Bluſhing for a Sign of Shame, than Gladneſs.

We

LXVI. *But we are prone to think otherwiſe, and why.*

We are nevertheleſs exceeding Prone to imagine, thoſe things which are perceived only by the Mediation of others, to be themſelves the immediate Objects of Sight: Or, at leaſt, to have in their own Nature a Fitneſs to be ſuggeſted by them, before ever they had been experienced to Coexiſt with them. From which prejudice every one, perhaps, will not find it eaſy to emancipate himſelf, by any the cleareſt Convictions of Reaſon. And there are ſome Grounds to think, that if there was one only invariable, and univerſal Language in the World, and that Men were born with the Faculty of ſpeaking it; it wou'd be the Opinion of ſome, that the *Ideas* in other Mens Minds were properly perceived by the Ear, or had at leaſt a neceſſary and inſeparable Tye with the Sounds that were affixed to them. All which ſeems to ariſe, from want of a due Application of our Diſcerning Faculty, thereby to Diſcriminate between the *Ideas* that are in our Underſtandings, and conſider them apart from each other ; which wou'd perſerve us from confounding thoſe that are different, and make us to ſee what *Ideas* do, and what do not include, or imply this or that other *Idea.*

LXVII. *The Moon ſeems greater in the* Horizon *than in the* Meridian.

THERE is a Celebrated *Phænomenon*, the Solution whereof I ſhall attempt to give, by the Principles that have been laid down, in reference to the manner wherein we apprehend by Sight, the Magnitude of Objects. It is as follows. The apparent Magnitude of the Moon when placed in the *Horizon*, is much greater than when it is in the *Meridian.* Tho' the Angle under which the Diameter of the Moon is ſeen, be not obſerv'd greater in the former Caſe, than in the latter. Moreover, the Horizontal Moon doth not conſtantly appear of the ſame Bigneſs, but at ſome times ſeemeth far Greater than at others.

LXVIII. *The cauſe of this Phænomenon, aſſigned.*

Now in order to explicate the reaſon, of the Moon's appearing greater than ordinary in the *Horizon*; it muſt be obſerv'd, that the Particles which compoſe our Atmoſphere, do intercept the Rays of Light proceeding from any Object to the Eye; and by how much the greater is the Portion of Atmoſphere, interjacent between the Object and the Eye, by ſo much the more are the Rays intercepted; and by conſequence, the Appearance of the Object render'd more Faint: Every Object appearing more Vigorous or more Faint, in Proportion as it ſendeth more or fewer Rays unto the Eye. Now, between the Eye, and the Moon, when ſituated in the *Horizon*, there lies a far greater Quantity of Atmoſphere, than there does when the Moon is in the *Meridian.* Whence it comes to paſs, that the Appearance of the Horizontal Moon is fainter, and therefore by *Sect.* LVI, it ſhou'd be thought bigger in that Situation, than in the *Meridian*, or in any other Elevation above the *Horizon.*

LXIX. *The Horizontal Moon, why greater at one time than another.*

FARTHER, The Air being variouſly impregnated, ſometimes more and ſometimes leſs, with Vapours and Exhalations fitted to retund and intercept the Rays of Light; it follows, that the Appearance of the Horizontal Moon hath not always an equal Faintneſs; and by Conſequence, that Luminary, tho' in the very ſame Situation, is at one time judged greater than at another.

LXX. *The Account we have given, prov'd to be true.*

THAT we have here given the true Account of the *Phænomena* of the Horizontal Moon, will, I ſuppoſe, be farther Evident to any one from the following Conſiderations. *Firſt*, 'Tis plain, that which in this Caſe ſuggeſts the *Idea* of greater Magnitude, muſt be ſomething which is it ſelf perceiv'd; for, that which is unperceiv'd cannot ſuggeſt to our Perception any other thing. *Secondly*, It muſt be ſomething that does not conſtantly remain the ſame, but is ſubject to ſome Change or Variation, ſince the Appearance of the Horizontal Moon varies, being at one time greater than at another. *Thirdly*, It muſt not lie in the Circumjacent or Intermediate Objects, ſuch as Mountains, Houſes, Fields, *&c.* becauſe, that when all thoſe Objects are excluded from Sight, the Appearance is as great as ever. And yet, *Fourthly*, It cannot be the Viſible Figure or Magnitude, ſince that remains the ſame, or is rather leſſer, by how much the Moon is nearer to the *Horizon.*

It remains therefore, that the true Cauſe is that Affection or Alteration of the Viſible Appearance, which proceeds from the greater Paucity of Rays arriving at the Eye, and which I term *Faintneſs* : Since this anſwers all the forementioned Conditions, and I am not conſcious of any other Perception that does.

LXXI.
And confirmed, by the Moon's appearing greater in a Miſt.

ADD to this, that in miſty Weather it is a common Obſervation, that the Appearance of the Horizontal Moon is far larger than uſual, which greatly conſpires with, and ſtrengthens our Opinion. Neither wou'd it prove, in the leaſt, Irreconcilable with what we have ſaid : If the Horizontal Moon ſhou'd chance ſometime to ſeem enlarged beyond its uſual Extent, even in more Serene Weather. For we muſt not only have regard to the Miſt, which happens to be in the place where we ſtand ; we ought alſo to take into our Thoughts, the whole Sum of Vapours and Exhalations, which lie betwixt the Eye and the Moon : All which cooperating to render the Appearance of the Moon more Faint, and thereby increaſe it's Magnitude, it may chance to appear greater than it uſually does, even in the Horizontal Poſition, at a time when, tho' there be no extraordinary Fog or Hazineſs, juſt in the place where we ſtand, yet, the Air between the Eye and the Moon, taken all together, may be loaded with a greater quantity of interſperſed Vapours and Exhalations, than at other times.

LXXII. *Objection anſwer'd.* It may be Objected, That in Conſequence of our Principles, the Interpoſition of a Body in ſome degree Opaque, which may Intercept a great Part of the Rays of Light, ſhou'd render the Appearance of the Moon in the *Meridian* as large, as when it is viewed in the *Horizon*. To which I anſwer, 'tis not Faintneſs any how apply'd, that ſuggeſts greater Magnitude. There being no neceſſary, but only an experimental Connexion between thoſe two things : It follows, that the Faintneſs, which enlarges the Appearance, muſt be applied in ſuch Sort, and with ſuch Circumſtances, as have been obſerved to attend the Viſion of great Magnitudes. When from a Diſtance we behold great Objects, the Particles of the intermediate Air and Vapours, which are themſelves unperceivable, do interrupt the Rays of Light, and thereby render the Appearance leſs Strong and Vivid ; now, Faintneſs of Appearance cauſed in this Sort, hath been experienced to coexiſt with great Magnitude. But, when it is cauſed by the Interpoſition of an Opaque, ſenſible Body, this Circumſtance alters the Caſe ; ſo that a Faint Appearance this way cauſed, does not ſuggeſt greater Magnitude, becauſe it hath not been experienced to coexiſt with it.

LXXIII. *The way wherein Faintneſs ſuggeſts greater Madnitude Illuſtrated.*

FAINTNESS, as well as all other *Ideas* or Perceptions, which ſuggeſt Magnitude or Diſtance, does it in the ſame way, that Words ſuggeſt the Notions to which they are annexed. Now, it is known, a Word pronounced with certain Circumſtances, or in a certain Context with other Words, hath not always the ſame Import and Signification, that it hath when pronounced in ſome other Circumſtances, or different Context of Words. The very ſame viſible Appearance as to Faintneſs and all other reſpects, if placed on high, ſhall not ſuggeſt the ſame Magnitude that it wou'd if it were ſeen at an equal Diſtance, on a level with the Eye. The reaſon whereof is, that we are rarely accuſtom'd to view Objects at a great Height. Our Concerns lie among things, ſituated rather before, than above us ; and accordingly, our Eyes are not placed on the top of our Heads, but in ſuch a Poſition, as is moſt convenient for us to ſee diſtant Objects ſtanding in our way. And this Situation of them being a Circumſtance, which uſually attends the Viſion of diſtant Objects, we may from hence account for (what is commonly obſerv'd) an Objects appearing of different Magnitude, even with reſpect to its Horizontal Extenſion, on the top of a Steeple, e. g. 100 Foot high to one ſtanding below, from what it wou'd, if placed at 100 Foot diſtance on a level with his Eye. For it hath been ſhewn, that the Judgment, we make on the Magnitude of a thing, depends not on the Viſible Appearance alone but alſo on divers other Circumſtances, any one of which being omitted or vary'd, may ſuffice to make ſome alteration in our Judgment. Hence, the Circumſtance of viewing a diſtant

Object in ſuch a Situation as is uſual, and ſuits with the ordinary Poſture of the Head and Eyes, being omitted, and in ſtead thereof a different Situation of the Object, which requires a different Poſture of the Head, taking place; it is not to be wonder'd at, if the Magnitude be judged different. But it will be demanded, why an high Object ſhou'd conſtantly appear leſs, than an equidiſtant low Object of the ſame Dimenſions, for ſo it is obſerv'd to be; it may, indeed, be granted that the variation of ſome Circumſtances may vary the Judgment, made on the Magnitude of high Objects, which we are leſs us'd to look at: But, it does not hence appear, why they ſhou'd be judged leſs rather than greater. I anſwer, that in caſe the Magnitude of diſtant Objects, was ſuggeſted by the Extent of their Viſible Appearance alone, and thought Proportional thereto, it's certain they wou'd then be judg'd much leſs than now they ſeem to be.

vid. Sect. LXXIX. But ſeveral Circumſtances concurring, to form the Judgment we make on the Magnitude of Diſtant Objects, by means of which they appear far larger than others, whoſe Viſible Appearance hath an equal or even greater Extenſion : It follows, that upon the change or omiſſion of any of thoſe Circumſtances, which are wont to attend the Viſion of Diſtant Objects, and ſo come to influence the Judgments made on their Magnitude, they ſhall proportionably appear leſs than otherwiſe they wou'd. For any of thoſe things, that caus'd an Object to be thought greater, than in proportion to it's Viſible Extenſion, being either omitted, or apply'd without the uſual Circumſtances, the Judgment depends more intirely on the Viſible Extenſion, and conſequently the Object muſt be judged leſs. Thus, in the preſent caſe, the Situation of the thing ſeen being different, from what it uſually is in thoſe Objects we have occaſion to view, and whoſe Magnitude we obſerve, it follows that the very ſame Object, being an hundred Foot high, ſhou'd ſeem leſs, than if it was an hundred Foot off on (or nearly on) a level with the Eye. What has been here ſet forth ſeems to me to have no ſmall ſhare in contributing to Magnify the Appearance of the Horizontal Moon, and deſerves not to be paſſed over in the Explication of it.

LXXIV. *Appearance of the Horizontal Moon. why thought difficult to explain.*

If we attentively conſider the *Phænomenon* before us, we ſhall find the not diſcerning between the Mediate, and Immediate Objects of Sight, to be the chief Cauſe of the Difficulty that occurs in the Explication of it. The Magnitude of the Viſible Moon, or that which is the proper and immedate Object of Viſion, is no greater when the Moon is in the *Horizon*, than when it is in the *Meridian*. How comes it, therefore, to ſeem greater er in one Situation than the other? What is it can put this Cheat on the Underſtanding? It has no other Perception of the Moon, than what it gets by Sight: And that which is ſeen is of the ſame Extent, I ſay, the Viſible Appearance hath the very ſame, or, rather, a leſs Magnitude when the Moon is view'd in the *Horizontal*, than when in the *Meridional* Poſition: And yet it is Eſteemed greater in the former, than in the latter. Herein conſiſts the Difficulty; which doth Vaniſh, and admit of a moſt eaſy Solution, if we conſider that, as the Viſible Moon is not greater in the *Horizon*, than in the *Meridian*, ſo neither is it thought to be ſo. It hath been already ſhewn, that in any act of *Viſion*, the Viſible Object abſolutely, or in it ſelf, is little taken notice of, the Mind ſtill carrying its View from that to ſome *Tangible Ideas*, which have been obſerv'd to be Connected with it, and by that means, come to be ſuggeſted by it. So that when a thing is ſaid to appear Great, or Small, or whatever Eſtimate be made of the Magnitude of any Thing; this is meant, not of the Viſible, but, of the Tangible Object. This duly conſider'd, it will be no hard matter to reconcile, the ſeeming Contradiction there is, that the Moon ſhou'd appear of a different Bigneſs, the viſible Magnitude thereof remaining ſtill the ſame. For by *Sect*. LVI. the very ſame viſible Extenſion, with a different Faintneſs, ſhall ſuggeſt a different Tangible Extenſion. When, therefore, the Horizontal Moon is ſaid to appear greater than the Meridional Moon; this muſt be underſtood, not of a greater *Viſible* Extenſion, but of a greater *Tangible* Extenſion; which, by reaſon of the more than ordinary *Faintneſs* of the Viſible Appearance, is ſuggeſted to the Mind along with it.

LXXV. *Attempts towards the Solution of it made by ſeveral, but in vain.*

Many Attempts have been made by Learned Men, to account for this Appearance. *Gaſſendus*, *Deſcartes*, *Hobbs*, and ſeveral others, have employed their Thoughts on that Subject: But how fruitleſs and unſatisfactory there Endeavours have been, is ſufficiently ſhewn by Mr. *Molyneux*, *vid Philoſ. Tranſ. Numb*. 187, *p*. 314. where you may ſee their ſeveral Opinions at large ſet forth and confuted, not without ſome Surpriſe at the groſs Blunders, that Ingenious Men have been forced into, by endeavouring to reconcile this Appearance with the ordinary Principles of *Optics*. Since the Writing of which Diſcourſe, there hath been Publiſh'd in the Tranſactions, *Numb*. 187, *p*. 323. another Paper relating to the ſame Affair, by the Celebrated Dr. *Wallis*, wherein he pretends to account for that *Phænomenon*; which, tho' it ſeems not to contain any thing new, or different from what had been ſaid before by others, I ſhall nevertheleſs conſider in this place.

LXXVI. *The Opinion of Dr.* Wallis.

His Opinion in ſhort is this. We judge not of the Magnitude of an Object by the Optic Angle alone, but by the Optic Angle in Conjunction with the Diſtance. Hence, tho' the Angle remain the ſame, or even become leſs; yet if withal the Diſtance ſeem to have been increas'd, the Object ſhall appear greater. Now, one way whereby we eſtimate the Diſtance of any thing, is by the Number and Extent of the intermediate Objects: When therefore the Moon is ſeen in the *Horizon*, the Variety of Fields, Houſes, *&c.* together with the large Proſpect of the wide-extended Land, or Sea that lies between the Eye and the utmoſt Limb of the *Horizon*, ſuggeſt unto the Mind the *Idea* of greater Diſtance, and conſequently magnify the Appearance. And this, according to Dr. *Wallis*, is the true Account of the extraordinary Largeneſs attributed by the Mind to the Horizontal Moon, at a time when the Angle ſubtended by its *Diameter*, is not one jot greater than it us'd to be.

LXXVII. *It is ſhewn to be unſatisfactory.*

WITH reference to this Opinion, not to repeat what has been already ſaid concerning *Diſtance*, I ſhall only obſerve, *Firſt*, That if the Proſpect of interjacent Objects be that which ſuggeſts the *Idea* of farther Diſtance, and this *Idea* of farther Diſtance be the Cauſe, that brings into the Mind the *Idea* of greater Magnitude; it ſhould hence follow, that if one look'd at the Horizontal Moon from behind a Wall, it would appear no bigger than ordinary. For in that Caſe, the Wall interpoſing cuts off all that Proſpect of Sea and Land, &c. which might otherwiſe increaſe the apparent Diſtance, and thereby the apparent Magnitude of the Moon. Nor will it ſuffice to ſay, the Memory doth even then ſuggeſt all that Extent of Land, &c. which lies within the Horizon ; which Suggeſtion occaſions a ſudden Judgment of Senſe, that the Moon is farther off, and larger than uſual. For ask any Man, who from ſuch a Station beholding the Horizontal Moon, ſhall think her greater than uſual, whether he have at that time in his Mind any *Idea* of the intermediate Objects, or long Tract of Land that lies between his Eye and the extream Edge of the Horizon ? And whether it be that *Idea* which is the Cauſe of his making the aforemention'd Judgment ?

ment? He will, without doubt, reply in the Negative, and declare the Horizontal Moon ſhall appear greater than the Meridional, tho' he never thinks of all or any of thoſe things that lie between him and it. And as for the Abſurdity of any *Ideas* introducing into the Mind another, whilſt it ſelf is not perceiv'd, this has already fallen under our Obſervation, and is too evident to need any farther Enlargement on it. *Secondly*, It ſeems impoſſible by this *Hypotheſis*, to account for the Moon's appearing in the very ſame Situation, at one time greater than at another. Which, nevertheleſs, has been ſhewn to be very agreeable to the Principles we have laid down, and receives a moſt eaſie and natural Explication from them.

LXXVIII. *How Lines and Angles may be of uſe in computing apparent Magnitudes.*

THIS *Phænomenon* of the Horizontal Moon is a clear Inſtance of the Inſufficiency of Lines and Angles, for explaining the way wherein the Mind perceives, and eſtimates the Magnitude of outward Objects. There is, nevertheleſs, a uſe of Computation by them, in order to determine the apparent Magnitude of things, so far as they have a Connexion with, and are Proportional to thoſe other *Ideas*, or Perceptions which are the true and immediate Occaſions that ſuggeſt to the Mind the apparent Magnitude of Things. But this in general may, I think, be obſerv'd concerning Mathematical Computation in *Optics*: That it can hardly be very Preciſe and Exact, ſince the Judgments we make of the Magnitude of External Things, do often depend on ſeveral Circumſtances, which are not Proportional to, or capable of being defin'd by *Lines* and *Angles*.

LXXIX. *One born Blind, being made to See, what Judgment he'd make of Magnitude.*

From what has been ſaid we may ſafely deduce this Conſequence, *viz.* That a Man born Blind, and made to See, wou'd, at firſt opening of his Eyes, make a very different Judgment of the Magnitude of Objects intromitted by them, from what others do. He wou'd not conſider the *Ideas* of Sight with reference to, or as having any Connexion with the *Ideas* of Touch. His View of them being intirely terminated within themſelves, he can no othewiſe judge them *Great* or *Small*, than as they contain a greater or leſſer Number of Viſible Points. Now, it being certain, that any Viſible Point can cover or exclude from View, only one other Viſible Point, it follows, that whatever Object intercepts the View of another, hath an equal Number of Viſible Points with it; and conſequently they ſhall both, by him, be thought to have the ſame Magnitude. Hence, it's evident, one in thoſe Circumſtances would judge his Thumb, with which he might hide a Tower, or hinder its being ſeen equal to that Tower, or his Hand, the Interpoſition whereof might cancel the Firmament from his View, equal to the Firmament: How great an Inequality ſoever there may, in our Apprehenſions, ſeem to be betwixt thoſe two things, becauſe of the cuſtomary and cloſe Connexion, that has grown up in our Minds between the Objects of *Sight* and *Touch*, whereby the very different and diſtinct *Ideas* of thoſe two Senſes, are ſo blended and confounded together, as to be miſtaken for one and the ſame thing; out of which Prejudice we cannot totally extricate our ſelves, without ſome Labour and Striving of Thought.

LXXX. *The* Minimum Viſibile *the ſame to all Creatures.*

For the better clearing up the Nature of *Viſion*, and ſetting the manner wherein we perceive Magnitudes in a due Light, I ſhall proceed to make ſome Obſervations concerning Matters relating thereto, whereof the want of Reflexion, and duly ſeparating between *Tangible* and *Viſible Ideas*, is apt to create in us miſtaken and confuſed Notions. And *Firſt* I ſhall obſerve, that the *Minimum Viſibile* is exactly equal in all Beings whatſoever, that are endow'd with the Viſive Faculty. No exquiſite Formation of the Eye, no peculiar Sharpneſs of Sight, can make it leſs in one Creature, than in another. For it not being diſtinguiſhable into Parts, nor in any wiſe conſiſting of them, it muſt neceſſarily be the ſame to all. For ſuppoſe it otherwiſe, and that the *Minimum Viſibile* of a Mite, for Inſtance, be leſs than the

Minimum Viſibile of a Man; the latter, therefore, may by Detraction of ſome part be made equal to the former: It doth, therefore, conſiſt of Parts: Which is inconſiſtent with the Notion of a *Minimum Viſibile*, or Point.

LXXXI. *Objection anſwer'd.*

It will, perhaps, be Objected, that the *Minimum Viſibile* of a Man doth really, and in it ſelf, contain Parts whereby it ſurpaſſes that of a Mite, tho' they are not perceivable by the Man. To which I anſwer, the *Minimum Viſibile* having (in like manner as all other the Proper and Immediate Objects of Sight) been ſhewn not to have any Exiſtence without the Mind of him who ſees it, it follows, there cannot be any part of it that is not actually perceiv'd, and therefore Viſible. Now, for any Object to contain ſeveral diſtinct, viſible Parts, and at the ſame time to be a *Minimum*

Minimum Viſibile, is a manifeſt Contradiction.

LXXXII. *The Eye at all times, perceives the ſame number of viſible Points.*

Of theſe Viſible Points we ſee at all times an equal Number. It is every whit as great when our View is contracted, and bounded by near Objects, as when it s extended to larger and remoter ones. For it being impoſſible, hat one *Minimum Viſibile* ſhould obſcure, or keep out of Sight, more than one other ; it's a plain Conſequence, that when my View s on all ſides bounded by the Walls of my Study, I ſee juſt s many viſible Points, as I cou'd, n caſe that by the Removal of he Study-Walls, and all other Obſtructions, I had a full Propect of the circumjacent Fields, Mountains, Sea, and open Firmament. For, ſo long as I am ſhut up within the Walls, by their nterpoſition every Point of the xternal Objects is cover'd from my View. But each Point that is ſeen, being able to cover or exclude from Sight, one only other correſponding Point : It follows, that whilſt my Sight is confin'd to thoſe narrow Walls, I ſee as many Points, or *Minima Viſibilia*, as I ſhou'd were thoſe Walls away, by looking on all the External Objects, whoſe Proſpect is intercepted by them. Whenever, therefore, we are ſaid to have a greater Proſpect at on time than another ; this muſt b understood with relation, not t the proper and immediate, bu the ſecondary and mediate Objects of Viſion, which, as hath been ſhewn, do properly belong to the *Touch*.

LXXXIII *Two Imperfections in the* Viſive Faculty.

The *Viſive Faculty* conſider'd with reference to it's immediat Objects, may be found to Labour of two Defects. *Firſt*, I reſpect of the Extent or Numbe

o

of viſible Points that are at once perceivable by it, which is narrow and limited to a certain Degree. It can take in at one View but a certain, determinate Number of *Minima Viſibilia*, beyond which it cannot extend it's Proſpect. *Secondly*, Our Sight is defective in that its View is not only narrow, but alſo, for the moſt part, confus'd. Of thoſe things that we take in at one Proſpect, we can ſee but a few at once clearly and unconfuſedly. And the more we fix our Sight on any one Object, by ſo much the Darker and more Indiſtinct ſhall the reſt appear.

LXXXIV. *Anſwering to which, we may conceive two Perfections.*

Corresponding to theſe two Defects of Sight, we may imagine as many Perfections, *viz.* 1*ſt.* That of comprehending in one View, a greater number of Viſible Points. 2*dly*, Of being able to View them all equally, and at once, with the utmoſt Clearneſs and Diſtinction. That thoſe Perfections are not actually in ſome Intelligences, of a different Order and Capacity from ours, it is impoſſible for us to know.

LXXXV. *In neither of theſe two Ways do Microſcopes improve the Sight.*

In neither of thoſe two Ways, do *Microſcopes* contribute to the improvement of Sight. For, when we look thro' a *Microſcope*, we neither ſee more Viſible Points, nor are the Collateral Points more Diſtinct, than when we look wit the naked Eye, at Objects placed in a due Diſtance. A *Microſcop* brings us, as it were, into a new World: It preſents us with a new Scene of Viſible Objects, quite different from what we behold with the naked Eye. But herein conſiſts the moſt remarkable Difference *viz.* That whereas the Objects perceived by the Eye alone have certain Connexion with *Tangibl* Objects, whereby we are taught t Foreſe

Foreſee what will enſue, upon the Approach or Application of diſtant Objects to the Parts of our own Body, which much conduceth to it's Preſervation; there is not the like Connexion between things *Tangible* and thoſe Viſible Objects, that are perceiv'd by help of a fine *Microſcope.*

LXXXVI. *The Caſe of Microſcopical Eyes, conſider'd.*

Hence it's evident, that were our Eyes turned into the Nature of *Microſcopes*, we ſhou'd not be much benefitted by the Change. We ſhou'd be depriv'd of the forementioned Advantage we at preſent receive by the *Viſive* Faculty; and have left us only the empty Amuſement of *Seeing*, without any other benefit ariſing from it. But in that Caſe, it will perhaps be ſaid our Sight wou'd be endued with a far greater Sharpneſs and Penetration than it now hath. But I wou'd fain know wherein conſiſts that *Sharpneſs*, which is eſteem'd ſo great an Excellency of Sight. It is certain from what we have already ſhewn, that the *Minimum Viſibile* is never Greater, or Leſſer, but in all Caſes conſtantly the ſame. And in the Caſe of Microſcopical Eyes, I ſee only this difference, *viz.* that upon the Ceaſing of a certain obſervable Connexion, betwixt the divers Perceptions of *Sight* and *Touch*, which before enabled us to regulate our Actions by the Eye: It wou'd now be render'd utterly unſerviceable to that Purpoſe. Which whether it be a deſirable Perfection, or no, I leave it to any one to determine.

LXXXVII. *The Sight, admirably adapted to the ends of Seeing.*

Upon the whole, my Opinion is, That If we conſider the Uſe and End of *Sight*, together with the preſent State and Circumſtances of our Being, we ſhall not find any great Cauſe, to complain of any Defect or Imperfection in it, or eaſily conceive how it cou'd be mended. With ſuch admirable Wiſdom is that Faculty contriv'd, both for the Pleaſure and Conveniency of Life.

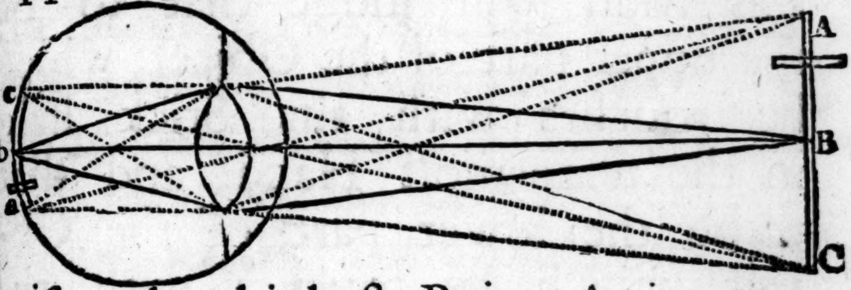
LXXXVIII *Difficulty concerning Erect Viſion.*

HAVING finiſh'd what I intended to ſay, concerning the *Diſtance* and *Magnitude* of Objects, I come now to treat of the Manner, wherein the Mind perceives by Sight their *Situation*. Among the Diſcoveries of the laſt Age, it is reputed none of the leaſt, that the manner of *Viſion* has been more clearly Explain'd, than eve~~n~~r it had been before. Their is, at this Day, no one Ignorant, that the Pictures of External Objects are Painted on the *Retina*, or Fund of the Eye. That we can ſee nothing which is not ſo Painted. And that, according as the Picture is more Diſtinct or Confuſed, ſo alſo is the Perception we have of the Object. But then in this Explication of *Viſion*, there occurs one mighty Difficulty. The Objects are Painted in an inverted Order on the Bottom of the Eye: The *upper* part of any Object being Painted on the *lower* part of the Eye, and the *lower* part of the Object, on the *upper* part of the Eye. And ſo alſo as to *Right* and *Left*. Since therefore the Pictures are thus inverted, it is demanded how it comes to paſs, that we ſee the Objects erect and in their natural Poſture?

LXXXIX *The common way of explaining it.*

In anſwer to this Difficulty, we are told, that the Mind perceiving an impulſe of a Ray of Light, on the upper part of the Eye, conſiders this Ray as coming in a direct Line, from the lower part of the Object; and in like manner tracing the Ray that ſtrikes on the lower part of the Eye, it is directed to the upper part of the Object. Thus in the adjacent Figure, *C* the lower Point of the

Object *ABC* is projected on *c* the upper part of the Eye. So likewiſe, the higheſt Point A is projected on *a* the loweſt part of the Eye; which makes the Repreſentation *c b a* inverted. But the Mind conſidering the Stroak that is made on *c* as coming in the ſtraight Line *Cc* from the lower End of the Object; and the Stroak or Impulſe on *a*, as coming in the Line *Aa* from the upper End of the Object, is directed to make a right Judgement of the Situation of the Object *ABC*, not withſtanding the Picture of it be inverted. Moreover, this is illuſtrated by conceiving a Blind Man, who holding in his Hands two Sticks that croſs each other, doth with them touch the extremities



of an Object, placed in a perpendicular Situation. It is certain, this Man will judge that to be the upper part of the Object, which he touches with the Stick held in the undermoſt Hand, and that to be the lower part of the Object, which he touches with the Stick in his uppermoſt Hand. This is the common Explication of the erect Appearance of Objects, which is generally receiv'd and acquieſced in being (as Mr. *Molyneux* tells us, *Dioptr. par.* 2. *c.* 7. *p.* 289.) *allowed by all Men as Satisfactory.*

XC. *The ſame ſhewn to be falſe.* But how reaſonable and ſatisfactory ſoever, this account may be thought by others, to me certainly it does not ſeem, in any degree, True. Did I perceive thoſe Impulſes, Decuſſations, and Directions of the Rays of Light, in like manner as hath been ſet forth, then, indeed, it wou'd not at firſt view be altogether void of Probability.

bability. And there might be ſome Pretence for the Compariſon of the Blind-Man and his croſs Sticks.. But the Caſe is far otherwiſe. I know very well that I perceive no ſuch thing. And of Conſequence, I cannot thereby make an Eſtimate of the Situation of Objects. Moreover I appeal to any one's Experience, whether he be conſcious to himſelf, that he thinks on the Interſection made by the Radious Pencils, or purſue the Impulſes they give in right Lines, whenever he perceives by Sight the Poſition of any Object? To me it ſeems evident, that Croſſing and Tracing of the Rays, &c. is never thought on by Children, Idiots, or in Truth by any other, ſave only thoſe who have applyed themſelves to the Study of *Optics*. And for the Mind to judge of the Situation of Objects, by thoſe things, without perceiving them, or to perceive them without knowing it, take which you pleaſe, ’tis perfectly beyond my Comprehenſion. Add to this, that the explaining the manner of *Viſion* by the Example of croſs Sticks, and Hunting for the Object along the Axes of the Radious Pencils, doth ſuppoſe the proper Objects of Sight to be perceived at a Diſtance from us, contrary to what hath been Demonſtrated. We may therefore, venture to pronounce this Opinion concerning the way wherein the Mind perceives the Erect Appearance of Objects, to be of a Piece with thoſe other Tenents of Writers in *Optics*, which in the foregoing Parts of this Treatiſe, we have had occaſion to Examine and Refute.

XCI. *Not diſtinguiſhing between* Ideas *of Sight and Touch, cauſe of Miſtake, in this Matter.*

It remains, therefore, that we look for ſome other Explication of this Difficulty. And I believe it not impoſſible to find one, provided we Examine it to the Bottom,

tom, and carefully diſtinguiſh between the *Ideas* of *Sight* and *Touch* ; which cannot be too oft inculcated in treating of *Viſion*. But more eſpecially throughout the conſideration of this Affair, we ought to carry that Diſtinction in our Thoughts. For that from want of a right Underſtanding thereof, the Difficulty of Explaining *Erect Viſion* ſeems chiefly to ariſe.

XCII. *The Caſe of one Born Blind, proper to be conſider'd.*

But in order to Diſentangle our Minds, from whatever Prejudices we may entertain with relation to the Subject in hand : Nothing ſeems more appoſite, than the taking into our Thoughts the Caſe of one Born Blind, and afterwards, when grown up, made to ſee. And tho' perhaps, it may not be a Task altogether eaſy, and familiar to us, to diveſt our ſelves intirely of the Experiences receiv'd from Sight : So as to be able to put our Thoughts exactly in the

Poſture of ſuch a one's. We muſt, nevertheleſs, as far as poſſible, endeavour to frame true Conceptions, of what might reaſonably be ſuppoſed to paſs in his Mind.

XCIII. *Such a one might by Touch, attain to have* Ideas *of* Upper *and* Lower.

It is certain, that a Man actually Blind, and who had continued ſo from his Birth, wou'd by the Senſe of Feeling attain to have *Ideas* of *Upper* and *Lower*. By the Motion of his Hand he might diſcern the Situation of any Tangible Object placed within his Reach. That part on which he felt himſelf ſupported, or towards which he perceiv'd his Body to gravitate, he wou'd term *Lower*, and the contrary to this *Upper*. And accordingly denominate whatſoever Objects he touch'd.

XCIV. *Which Modes of Situation he'd attribute only to things Tangible.*

But then, whatever Judgments he makes concerning the Situation of Objects, are confin'd to thoſe only that are perceivable by *Touch*.

All thoſe things that are Intangible, and of a ſpiritual Nature, his Thoughts and Deſires, his Paſſions, and in general all the Modifications of his Soul, to theſe he wou'd never apply the Terms *Upper* and *Lower*, except only in a Metaphorical Senſe. He may, perhaps, by way of Alluſion, ſpeak of High or Low Thoughts. But thoſe Terms in their proper Signification, wou'd never be applyed to any thing, that was not conceiv'd to exiſt without the Mind. For a Man Born Blind, and remaining in the ſame State, cou'd mean nothing elſe by the Words *Higher* and *Lower*, than a greater or leſſer Diſtance from the Earth: Which Diſtance he wou'd meaſure by the Motion or Application of his Hand, or ſome other Part of his Body. It is, therefore, evident, that all thoſe things which, in reſpect of each other, wou'd by him be thought Higher or Lower, muſt be ſuch as were conceiv'd to exiſt without his Mind, in the ambient Space.

XCV. *He'd not at firſt Sight think any thing he ſaw, High or Low, Erect or Inverted.*

Whence it plainly follows, that ſuch a one, if we ſuppoſe him made to See, wou'd not at firſt Sight think, that any thing he ſaw was High or Low, Erect or Inverted; for it hath been already Demonſtrated in *Sect.* XLI, that he wou'd not think the Things he perceived by Sight to be at any Diſtance from him, or without his Mind. The Objects to which he had hitherto been uſed to apply the Terms *Up* and *Down*, *High* and *Low*, were ſuch only as affected, or were ſome way perceiv'd by his Touch. But the proper Objects of *Viſion* make a new Set of *Ideas*, perfectly diſtinct and different from the former, and which can in no ſort make themſelves perceiv'd by *Touch*. There is, therefore, nothing at all that cou'd induce him to think thoſe Terms applicable to them. Nor wou'd he ever think it, till ſuch time as he had obſerv'd their Connexion with Tangible Objects, and the ſame Prejudice begin to inſinuate it ſelf into his Underſtanding, which from their Infancy had grown up in the Underſtandings of other Men.

XCVI. *This Illuſtrated by an Example.*

To ſet this Matter in a clearer Light, I ſhall make uſe of an Example. Suppoſe the above-mentioned Blind Perſon do, by his Touch, perceive a Man to ſtand Erect. Let us enquire into the manner of this. By the application of his Hand to the ſeveral Parts of a Human Body, he had perceiv'd different Tangible *Ideas*, which being collected into ſundry complex ones have diſtinct Names annexed to them. Thus one Combination of a certain Tangible Figure, Bulk, and Conſiſtency of Parts is called the *Head*, another the *Hand*, a Third the *Foot*, and ſo of the reſt. All which Complex *Ideas* cou'd, in his Underſtanding, be made up only of *Ideas* perceivable by Touch. He had alſo by his Touch obtain'd an *Idea* of Earth or Ground, towards which he perceives the Parts of his Body to have a natural Tendency. Now, by *Erect* nothing more being meant, than that perpendicular Poſition of a Man, wherein his Feet are neareſt to the Earth: If the Blind Perſon by moving his Hand, over the Parts of the Man who ſtands before him, do perceive the Tangible *Ideas* that compoſe the Head, to be fartheſt from, and thoſe that compoſe the Feet to be neareſt to, that other Combination of Tangible *Ideas* which he calls *Earth* : He will denominate that Man *Erect*. But if we ſuppoſe him on a ſudden to receive his Sight, and that he behold a Man ſtanding before him : It's evident, in that Caſe, he wou'd neither judge the Man he ſees, to be *Erect* nor *Inverted* ; for he never having known thoſe Terms applied to any other, ſave Tangible Things, or which exiſted in the Space without him, and what he ſees neither being Tangible, nor perceived as exiſting without, he cou'd not know that in propriety of Language, they were applicable to it.

XCVII. *By what means he'd come to denominate Viſible* Objects *high or low*, &c.

Afterwards, when upon turning his Head or Eyes, up and down, to the right and left, he ſhall obſerve the Viſible Objects to change, and ſhall alſo attain to know, that they are call'd by the ſame Names, and Connected with the Objects perceiv'd by Touch ; then, indeed, he will come to ſpeak of them, and their Situation, in the the ſame Terms that he has been uſ'd to apply to Tangible Things, And thoſe that he perceives by turning up his Eyes, he will call

Upper, and thoſe that by turning down his Eyes, he will call *Lower.*

XCVIII. *Why he ſhou'd think thoſe* Objects *higheſt, which are Painted on the loweſt part of his Eye, and* vice verſâ

And this ſeems to me the true Reaſon, why he ſhou'd think thoſe Objects uppermoſt that are Painted on the lower part of his Eye. For, by turning the Eye *up* they ſhall be diſtinctly ſeen; as likewiſe they that are Painted on the higheſt part of the Eye ſhall be diſtinctly ſeen, by turning the Eye *down*, and are for that Reaſon eſteemed loweſt. For we have ſhewn that to the immediate Objects of Sight, conſider'd in themſelves, he'd not attribute the Terms *High* and *Low*. It muſt therefore be on account of ſome Circumſtances, which are obſerv'd to attend them. And theſe, 'tis plain, are the Actions of turning the Eye up and down, which ſuggeſt a very obvious Reaſon, why the Mind ſhou'd denominate the Objects of Sight accordingly *High* or *Low*. And without

out this Motion of the Eye, this turning it up and down in order to diſcern different Objects, doubtleſs *Erect*, *Inverſe*, and other the like Terms relating to the Poſition of Tangible Objects, wou'd never have been transfer'd, or in any degree apprehended to belong to the *Ideas* of Sight: The meer act of Seeing including nothing in it to that Purpoſe, whereas the different Situations of the Eye, naturally direct the Mind to make a ſuitable Judgement, of the Situation of Objects intromitted by it.

XCIX. *How he wou'd perceive by Sight the Situation of External Objects.*

FARTHER, when he has by Experience learn'd the Connexion there is, between the ſeveral *Ideas* of Sight and Touch, he will be able, by the Perception he has of the Situation of Viſible Things in reſpect of one another to make a ſudden and true Eſtimate, of the Situation of Outward, Tangible things correſponding to them. And thus it is, he ſhall perceive by Sight the Situation of External Objects, which do not properly fall under that Senſe.

C. *Our propenſion to think the contrary, no Argument againſt what hath been ſaid.*

I know we are very prone to think, that if juſt made to ſee, we ſhou'd judge of the Situation of Viſible Things as we do now. But, we are alſo as prone to think, that at firſt Sight, we ſhou'd in the ſame way apprehend the Diſtance and Magnitude of Objects, as we do now. Which hath been ſhewn to be a falſe and groundleſs Perſwaſion. And for the like Reaſons, the ſame Cenſure may be paſt on the poſitive Aſſurance, that moſt Men, before they have thought ſufficiently of the Matter, might have of their being able to determine by the Eye, at firſt view, whether Objects were *Erect* or *Inverſe*.

CI. *Objection.*

It will, perhaps, be Objected to our Opinion, that a Man, for inſtance,

ſtance, being thought Erect, when his Feet are next the Earth, and Inverted, when his Head is next the Earth, it doth hence follow, that by the meer act of Viſion, without any Experience or altering the Situation of the Eye, we ſhou'd have determined whether he were Erect or Inverted. For both the Earth it ſelf, and the Limbs of the Man who ſtands thereon, being equally perceiv'd by Sight: One cannot chuſe ſeeing, what part of the Man is neareſt the Earth, and what part fartheſt from it, *i. e.* whether he be Erect or Inverted.

CII. *Anſwer.*

To which I anſwer, the *Ideas* which conſtitute the Tangible Earth and Man, are intirely different from thoſe which conſtitute the Viſible Earth and Man. Nor was it poſſible, by virtue of the Viſive Faculty alone, without ſuper-adding any Experience of *Touch*, or altering the Poſition of the Eye, ever to have known, or ſo much as ſuſpected, there had been any Relation or Connexion between them. Hence, a Man at firſt view wou'd not denominate any thing he ſaw *Earth*, or *Head*, or *Foot*, And conſequently, he cou'd not tell by the meer act of *Viſion*, whether the Head or Feet were neareſt the Earth. Nor indeed, wou'd he have thereby any thought of *Earth* or *Man*, *Erect* or *Inverſe*, at all. Which will be made yet more evident, if we nicely obſerve, and make a particular Compariſon between the *Ideas* of both Senſes.

CIII. *An Object cou'd not be known at firſt Sight by the Colour.*

THAT, which I ſee is only variety of Light and Colours. That which I feel, is Hard or Soft, Hot or Cold, Rough or Smooth. What Similitude, what Connexion have thoſe *Ideas* with theſe? Or how is it poſſible, that any one ſhou'd ſee reaſon, to give one and the ſame Name, to combinations of *Ideas* ſo very different, before he had experienced their Coexiſtence? We do not find there is any neceſſary Connexion, betwixt this or that Tangible Quality, and any Colour whatſoever. And we may ſometimes perceive Colours, where there is nothing to be felt. All which doth make it manifeſt, that no Man at firſt receiving of his Sight, wou'd know there was any Agreement between this or that particular Object of his Sight, and any Object of Touch he had been already acquainted with. The Colours therefore of the Head, wou'd to him no more ſuggeſt the *Idea* of *Head*, than they wou'd the *Idea* of *Feet*.

CIV. *Nor by the Magnitude thereof.*

FARTHER, we have at large ſhewn (*vid. Sect.* LXIII and LXIV.) there is no diſcoverable, neceſſary Connexion, between any given Viſible Magnitude, and any one particular Tangible Magnitude. Bu that it is intirely the reſult o Cuſtom and Experience, and depends on foreign and accidenta Circumſtances, that we can b the Perception of Viſible Extenſion inform our ſelves, what ma be the Extenſion of any *Tangib* Object connected with it. Hence 'tis certain that neither the Viſible Magnitude of Head or Foo wou'd bring along with them into the Mind, at firſt opening o the Eyes, the reſpective Tangib Magnitudes of thoſe Parts.

CV. *Nor by the Figure.* By the foregoing *Section* 'tis plain the Viſible Figure of any Part o the Body, hath no neceſſary Connexion with the Tangible Figur thereof, ſo as at firſt Sight to ſuggeſt it to the Mind. For *Figur* is the Termination of Magnitud Whence it follows, that no Viſible Magnitude having, in it's ow Nature, an aptneſs to ſuggeſt an

on

one particular Tangible Magnitude, ſo neither can any Viſible Figure be inſeparably Connected with its correſponding Tangible Figure: So as of it ſelf, and in a way *prior* to Experience it might ſuggeſt it to the Underſtanding. This will be farther evident, if we conſider that what ſeems Smooth and Round to the Touch, may to Sight, if view'd thro' a *Microſcope*, ſeem quite otherwiſe.

CVI. *In the firſt act of Viſion, no Tangible Thing wou'd be ſuggeſted by Sight.*

From all which laid together, and duly conſider'd, we may clearly deduce this Inference, *viz.* In the firſt act of Viſion, no *Idea* entering by the Eye, wou'd have a perceivable Connexion with the *Ideas* to which the Names *Earth*, *Man*, *Head*, *Foot*, &c. were annexed, in the Underſtanding of a Perſon Blind from his Birth: So as in any ſort to introduce them into his Mind, or make themſelves be called by the ſame Names, and reputed the ſame things with them, as afterwards they come to be.

CVII. *Difficulty propoſed concerning Number.* There doth, nevertheleſs, remain one Difficulty, which to ſome perhaps, may ſeem to preſs hard on our Opinion, and deſerve not to be paſs'd over. For tho' it be granted, that neither the Colour, Size, nor Figure of the Viſible Feet, have any neceſſary Connexion with the *Ideas* that compoſe the Tangible Feet, ſo as to bring them at first ſight, into my Mind, or make me in danger of confounding them, before I had been us'd to, and for ſome time experienced their Connexion. Yet thus much ſeems undeniable. Namely, that the Number of the Viſible Feet, being the ſame with that of the Tangible Feet: I may from hence, without any Experience of Sight, reaſonably conclude that they repreſent, or are connected with the Feet rather than the Head, I ſay, it ſeems the *I-*

dea of *Two* Viſible Feet will ſooner ſuggeſt to the Mind, the *Idea* of *Two* Tangible Feet than of *one* Head. So that the Blind Man upon firſt reception of the Viſive Faculty might know, which were the Feet or Two, and which, the Head or One.

CVIII. *Number of things Viſible, wou'd not, at firſt Sight, ſuggeſt the like number of things Tangible.*

In order to get clear of this ſeeming Difficulty, we need only obſerve, that Diverſity of Viſible Objects does not neceſſarily infer, Diverſity of Tangible Objects, correſponding to them. A Picture Painted with great variety of Colours, affects the Touch in one uniform manner. It is therefore evident, that I do not by any neceſſary Conſecution, independent of Experience, judge of the number of things Tangible, from the number of things Viſible. I ſhou'd not therefore at firſt opening my Eyes conclude, that becauſe I ſee Two, I ſhall feel Two.

How therefore can I, before Experience teaches me, know that the Viſible Legs, becauſe *Two*, are connected with the Tangible Legs: Or the Viſible Head, becauſe *One*, connected with the Tangible Head? The Truth on't is, the things I ſee are ſo very different, and heterogeneous from the things I feel: That the Perception of the one, wou'd never have ſuggeſted the other to my Thoughts, or enabled me to paſs the leaſt Judgment thereon, until I had Experienced their Connexion.

CIX. *Number, the Creature of the Mind.*

But for a fuller Illuſtration of this Matter, it ought to be conſider'd that *Number* (however ſome may reckon it amongſt the Primary Qualities) is nothing fix'd, and ſettled, really exiſting in things themſelves. It is intirely the Creature of the Mind, conſidering, either a Simple *Idea* by it ſelf, or any Combination of Simple *Ideas* to which it gives one Name, and ſo makes it paſs for an Unite. According as the Mind variouſly Combines it's *Ideas*, the Unites varies. And as the Unite, ſo the Number, which is only a Collection of Unites doth alſo vary. We call a Window *one*, a Chimney *one*; and yet a Houſe in which there are many Windows, and many Chimneys, has an equal right to be called *one*, And many Houſes go to the making of *one* City. In theſe and the like Inſtances, it's evident the *Unite* conſtantly relates to the particular Draughts the Mind makes of it's *Ideas*, to which it affixes Names, and wherein it includes more or leſs, as beſt ſuits it's own Ends and Purpoſes. Whatever therefore the Mind conſiders as one, that is an Unite. Every Combination of *Ideas* is conſider'd as one thing by the Mind, and in token thereof, is mark'd by one Name. Now, this Naming and Combining together of *Ideas* is perfectly Arbitrary, and done by the Mind in ſuch ſort, as Experience ſhews it to be moſt convenient. Without which, our *Ideas* had never been collected into ſuch ſundry, diſtinct Combinations, as they now are.

CX. *One Born Blind wou'd not at firſt Sight, number Viſible Things as others do.*

HENCE it follows, that a Man Born Blind, and afterwards, when grown up made to ſee, wou'd not in the firſt act of Viſion, parcel out the *Ideas* of Sight, into the ſame diſtinct Collections that others do, who have experienced which do regularly coexiſt and are proper to be bundled up together under one Name. He wou'd not, for Example, make into one Complex *Idea*, and thereby eſteem an unite all thoſe particular *Ideas* which conſtitute the Viſible Head, or Foot. For there can be no Reaſon aſſign'd why he ſhou'd do ſo, barely upon his ſeeing a Man ſtand upright before him. There croud into his Mind, the *Ideas* which compoſe the Viſible Man, in company with all the other *Ideas* of Sight perceiv'd at the ſame time. But all theſe *Ideas* offer'd at once to his View, he'd not diſtribute into ſundry, diſtinct Combinations: till ſuch time as, by obſerving the Motion of the Parts of the Man and other Experiences, he comes to know, which are to be ſeparated, and which to be collected together.

CXI. *The Situation of any Object, determin'd with reſpect only to Objects of the ſame Senſe.*

From what hath been premiſed, 'tis plain the Objects of Sight and Touch make, if I may ſo ſay, two Sets of *Ideas*, which are widely different from each other. To Objects of either Kind, we indifferently attribute the Terms *High* and *Low*, *Right* and *Left*, and ſuch like, denoting the Poſition or Situation of things. But then we muſt well obſerve, that the Poſition of any Object is determin'd,

with

with reſpect only to Objects of the ſame Senſe. We ſay any Object of Touch is *High* or *Low*, according as it is more or leſs diſtant from the Tangible Earth. And in like manner, we denominate any Object of Sight *High* or *Low*, in proportion as it is more or leſs Diſtant, from the Viſible Earth. But to define the Situation of Viſible Things, with relation to the diſtance they bear from any Tangible Thing, or *vice verſa*: This were abſurd and perfectly unintelligible. For all Viſible Things are equally in the Mind, and take up no part of the External Space : And, conſequently, are Equidiſtant from any Tangible Thing which exiſts withou the Mind.

CXII. *No Diſtance great or ſmall, between a Viſible and Tangible Thing.*

Or rather, to ſpeak truly, the proper Objects of Sight are at no Diſtance, neither near nor far, from any Tangible Thing. For if w

inquir

inquire narrowly into the Matter, we ſhall find, that thoſe things only are compar'd together in reſpect of Diſtance, which exiſt after the ſame manner, or appertain unto the ſame Senſe. For by the *Diſtance* between any Two Points, nothing more is meant than the Number of intermediate Points. If the given Points are Viſible, the Diſtance between them is mark'd out, by the Number of the interjacent Viſible Points: If they are Tangible, the Diſtance between them is a Line conſiſting of Tangible Points. But if they are one Tangible, and the other Viſible, the Diſtance between them doth neither conſiſt of Points perceivable by Sight, nor by Touch, *i. e.* it is utterly inconceivable. This, perhaps, will not find an eaſy Admiſſion into all Men's Underſtanding: However, I ſhou'd gladly be informed whether it be not True, by any one who will be at the pains to Reflect a little, and apply it home to his Thoughts.

CXIII. *The not obſerving this, cauſe of difficulty in Erect Viſion.*

THE not obſerving what has been deliver'd in the two laſt *Sections*, ſeems to have occaſion'd no ſmall part of the Difficulty that occurs in the Buſineſs of *Erect Appearances*. The Head, which is Painted neareſt the Earth, ſeems to be fartheſt from it ; and on the other Hand, the Feet, which are Painted fartheſt from the Earth, are thought neareſt to it. Herein lies the Difficulty, which vaniſhes if we expreſs the thing more clearly, and free from Ambiguity, thus. How comes it that to the Eye, the Viſible Head which is neareſt the Tangible Earth, ſeems fartheſt from the Earth, and the Viſible Feet, which are fartheſt from the Tangible Earth, ſeem neareſt the Earth ? The Queſtion being thus propos'd, who ſees not;

the Difficulty is founded on a Suppoſition, that the Eye or Viſive Faculty, or rather the Soul by means thereof, ſhou'd judge of the Situation of Viſible Objects, with Reference to their Diſtance from the Tangible Earth ? Whereas it's evident, the Tangible Earth is not perceiv'd by Sight : And it hath been ſhewn in the two laſt preceding *Sections*, that the Location of Viſible Objects is determin'd only, by the Diſtance they bear from one another ; and that it is Nonſenſe to talk of Diſtance, far or near, between a Viſible and Tangible Thing.

CXIV. *Which otherwiſe includes nothing unaccountable.*

If we confine our Thoughts to the proper Objects of Sight, the whole is plain and eaſy. The Head is Painted fartheſt from, and the Feet neareſt to the Viſible Earth : And ſo they appear to be. What is there ſtrange or unaccountable in this ? Let us ſuppoſe the Pictures in the Fund of the Eye, to be the immediate Objects of Sight. The Conſequence is, that things ſhou'd appear in the ſame Poſture they are Painted in. And is it not ſo ? The Head which is ſeen, ſeems fartheſt from the Earth which is ſeen ; and the Feet, which are ſeen, ſeem neareſt to the Earth which is ſeen. And juſt ſo they are Painted.

CXV. *What is meant by the Pictures being Inverted.*

But, ſay you, the Picture of the Man is *Inverted*, and yet the Appearance is *Erect*. I ask what mean you by the Picture of the Man, or, which is the ſame thing, the Viſible Man's being inverted ? You tell me 'tis Inverted, becauſe the Heels are uppermoſt, and the Head undermoſt ? Explain me this. You ſay, that by the Head's being undermoſt, you mean that it is neareſt to the Earth ; and by the Heels being uppermoſt, that they are fartheſt from the Earth. I ask again,

gain, what Earth you mean? You cannot mean the Earth that is Painted on the Eye, or the Viſible Earth. For the Picture of the Head is fartheſt from the Picture of the Earth; and the Picture of the Feet neareſt to the Picture of the Earth; and accordingly, the Viſible Head is fartheſt from the Viſible Earth, and the Viſible Feet, neareſt to it. It remains, therefore, that you mean the Tangible Earth: and And ſo determine the Situation of *Viſible* Things, with reſpect to *Tangible* Things; contrary to what hath been demonſtrated in *Sect.* CXI. and CXII. The two diſtinct Provinces of *Sight* and *Touch* ſhou'd be conſider'd apart, and as tho' their Objects had no Intercourſe, no manner of Relation to one another, in point of Diſtance or Poſition.

CXVI. *Cauſe of Miſtake in this Matter.* FARTHER, What greatly contributes to make us miſtake in this Matter is, that when we think of the Pictures in the Fund of the Eye, we imagine our ſelves looking on the Fund of another's Eye, or another looking on the Fund of our own Eye, and beholding the Pictures Painted thereon. Suppoſe two Eyes *A* and *B* : *A* from ſome diſtance looking on the Pictures in *B* ſees them Inverted, and for that reaſon concludes they are Inverted in *B*. But this is wrong. There are projected in *little* on the Bottom of *A*, the Images of the Pictures of, ſuppoſe, *Man*, *Earth*, &c. which are Painted on *B*. And beſides theſe, the Eye *B* it ſelf, and the Objects which environ it, together with another Earth are projected in a larger Size on *A*. Now, by the Eye *A*, theſe larger Images are deemed the *true* Objects, and the leſſer only *Pictures* in miniature. And it is with reſpect to thoſe greater Images, that it determines the Situation of the ſmaller Images. So that comparing the little Man with the great Earth, *A* judges him inverted, or that the Feet are fartheſt from, and the Head neareſt to the great Earth. Whereas, if *A* compare the little Man with the little Earth, then he will appear Erect, *i. e.* his Head ſhall ſeem fartheſt from, and his Feet neareſt to the little Earth. But we muſt conſider that *B* does not ſee two Earths as *A* does: It ſees only what is repreſented by the little Pictures in *A*, and conſequently ſhall judge the Man *Erect*. For, in truth, the Man in *B* is not Inverted, for there, the Feet are next the Earth. But it is the Repreſentation of it in *A* which is Inverted, for there, the Head of the Repreſentation of the Picture of the Man in *B*, is next the Earth, and the Feet fartheſt from the Earth, meaning the Earth which is without the Repreſentation of the Pictures in *B*. For if you take the little Images of the Pictures in *B*, and conſider them by themſelves, and with reſpect only to one another, they are all *Erect* and in their natural Poſture.

CXVII. *Images in the Eye, not Pictures of external Objects.*

Farther, there lies a Miſtake, in our imagining that the Pictures of External Objects are Painted on the Bottom of the Eye. It hath been ſhewn, there is no reſemblance between the *Ideas* of Sight, and things Tangible. It hath likewiſe been demonſtrated, that the proper Objects of Sight do not exiſt without the Mind. Whence it clearly follows, that the Pictures Painted on the Bottom of the Eye, are not the Pictures of External Objects. Let any one conſult his own Thoughts, and then tell me, what Affinity, what Likeneſs there is, between that certain Variety and Diſpoſition of Colours, which conſtitute the Viſible Man, or Picture of a

Man, and that other Combination of far different *Ideas*, ſenſible by Touch, which compoſe the Tangible Man. But if this be the Caſe, how come they to be accounted *Pictures* or *Images*, ſince that ſuppoſes them to copy or repreſent ſome Originals or other?

CXVIII. *In what Senſe they are Pictures*

To which I anſwer. In the forementiond Inſtance, the Eye *A* takes the little Images, included within the Repreſentation of the other Eye *B*, to be Pictures or Copies, whereof the *Archetypes* are not things exiſting without, but the larger Pictures projected on it's own Fund: And which by *A* are not thought Pictures, but the Originals or true Things themſelves. Tho' if we ſuppoſe a third Eye *C*, from a due diſtance to behold the Fund of *A*: Then indeed, the things projected thereon ſhall, to *C*, ſeem Pictures or Images, in the ſame Senſe that thoſe projected on *B* do to *A*.

CXIX. *In this Affair we muſt carefully diſtinguiſh between Ideas of Sight and Touch.*

RIGHTLY to conceive the Buſineſs in hand, we muſt carefully diſtinguiſh between the *Ideas* of *Sight* and *Touch*, between the Viſible and Tangible Eye, for certainly on the Tangible Eye, nothing either is or ſeems to be Painted. Again, the Viſible Eye, as well as all other Viſible Objects, hath been ſhewn to exiſt only in the Mind, which perceiving its own *Ideas*, and comparing them together, does call ſome Pictures in reſpect of others. What hath been ſaid being rightly comprehended and laid together, does, I think, afford a full and genuine Explication of the Erect Appearance of Objects; which *Phænomenon*, I muſt confeſs, I do not ſee how it can be explain'd, by any *Theories* of *Viſion* hitherto made publick.

In treating of theſe things, the uſe of Language is apt to occaſion ſome Obſcurity and Confuſion, and create in us wrong *Ideas.* For Language being accomodated to the common Notions and Prejudices of Men, it is ſcarce poſſible to deliver the naked and preciſe Truth, without great Circumlocution, Impropriety, and (to an unwary Reader) ſeeming Contradictions. I do therefore, once for all, deſire whoever ſhall think it worth his while to underſtand what I have written concerning *Viſion*, that he'd not ſtick in this or that Phraſe, or manner of Expreſſion; but candidly collect my meaning from the whole Sum and Tenor of my Diſcourſe; and laying aſide the Words, as much as poſſible, conſider the bare Notions themſelves, and then judge whether they are agreeable to Truth and his own Experience, or no.

CXX. *Difficult to explain by Words the true* Theory *of* Viſion.

CXXI. *The Queſtion, whether there is any* Idea *common to* Sight *and* Touch, *ſtated.*

We have ſhewn the way wherein the Mind by Mediation of Viſible *Ideas*, doth perceive or apprehend the *Diſtance*, *Magnitude* and *Situation* of Tangible Objects. I come now to enquire more particularly, concerning the Difference betwixt the *Ideas* of *Sight* and *Touch*, which are call'd by the ſame Names; and ſee whether there be any *Idea* common to both Senſes. From what we have at large ſet forth and demonſtrated in the foregoing parts of this Treatiſe, 'tis plain there's no one ſelf-ſame numerical Extenſion, perceiv'd both by Sight and Touch. But that the particular Figures and Extenſions perceiv'd by Sight, however they may be called by the ſame Names, and reputed the ſame Things, with thoſe perceiv'd by Touch, are nevertheleſs different, and have an Exiſtence very diſtinct and ſeparate from them. So that the Queſtion is not now concerning the ſame numerical *Ideas*, but whether there be any one and the ſame ſort or *Species* of *Ideas* equally perceivable to both Senſes ? Or, in other Words, whether Extenſion, Figure, and Motion perceiv'd by Sight, are not ſpecifically diſtinct from Extenſion, Figure and Motion perceived by Touch.

CXXII. *Abſtract Extenſion enquir'd into.*

BUT, before I come more particularly to Diſcuſs this Matter, I find it proper to take into my Thoughts Extenſion in *Abſtract* : For of this there is much talk, and I am apt to think, that when Men ſpeak of *Extenſion* as being an *Idea* common to Two Senſes, it is with a ſecret Suppoſition, that we can ſingle out Extenſion from all other Tangible and Viſible Qualities, and form thereof an Abſtract *Idea*, which *Idea* they will have common both to

Sight and Touch. We are therefore to underſtand by *Extenſion in Abſtract*, an *Idea* of Extenſion *v. g.* a Line or Surface, intirely ſtript of all other ſenſible Qualities and Circumſtances that might determine it to any particular Exiſtence. It is neither Black, nor White, nor Red, nor hath it any Colour at all, or any Tangible Quality whatſoever. And conſequently it is of no finite, determinate Magnitude. For, that which bounds or diſtinguiſhes one Extenſion from another, is ſome Quality or Circumſtance wherein they diſagree.

CXXIII. *It is incombenpreſible.* Now I do not find that I can perceive, imagine, or any wiſe frame in my Mind ſuch an abſtract *Idea*, as is here ſpoken of. A Line, or Surface which is neither Black, nor White, nor Blue, nor Yellow, *&c.* Nor Long, nor Short, nor Rough, nor Smooth, nor Square, nor Round, *&c.* is perfectly incomprehenſible. This I am ſure of as to my ſelf, how far the Faculties of other Men may reach, they beſt can tell.

CXXIV. *Abſtract Extenſion not the Object of Geometry.*

I KNOW 'tis commonly ſaid, that the Object of *Geometry* is Abſtract Extenſion. To this I cannot agree, for *Geometry* contemplates Figures: Now, Figure is the Termination of Magnitude, but we have ſhewn that Extenſion in Abſtract hath no finite, determinate Magnitude, whence it clearly follows that it can have no Figure, and conſequently is not the Object of *Geometry*. I know it is a Tenent as well of the Modern as the Ancient Philoſophers, that all general Truths are concerning Univerſal, Abſtract *Ideas*, without which, we are told, there cou'd be no Science, no Demonſtration of any general Propoſition in *Geometry*. But it were no hard matter, did I think it neceſſary to my preſent Purpoſe, to ſhew that Propoſitions and Demonſtrations in *Geometry* might be Univerſal, tho' they who make 'em, never think of Abſtract general *Ideas* of Triangles or Circles.

CXXV. *The general Idea of a Triangle, conſider'd.*

After reiterated Efforts and pangs of Thought, in order to apprehend the general *Idea* of *v. g.* a Triangle, I have found it altogether incomprehenſible. And ſurely if any one were able to let that *Idea* into my Mind, it muſt be the deſervedly admir'd Author of the Eſſay *concerning Human Underſtanding* : He, who has ſo far diſtinguiſh'd himſelf from the generality of Writers, by the Clearneſs and Significancy of what he Says. Let us therefore ſee how that great Man deſcribes the general, or, which is the ſame thing, the Abſtract *Idea* of a Triangle. 'It muſt be, (*ſays he*) neither Ob-

'lique, nor Rectangle, neither Equilateral, Equicrural, nor Scalenon; but *all and none* of theſe at once. In effect it is ſomewhat imperfect that cannot exiſt; an *Idea*, wherein ſome Parts of ſeveral different and inconſiſtent *Ideas* are put together. *Eſſay on Hum. Underſtand. b.* iv. *c.* 7. *ſ.* 9. This is the *Idea*, which he thinks needful, for the enlargement of Knowledge, which is the Subject of Mathematical Demonſtration, and without which we could never come to know any general Propoſition concerning Triangles. Sure I am, if this be the Caſe, 'tis impoſſible for me to attain to know even the firſt Elements of *Geometry*: Since I have not the Faculty to frame in my Mind ſuch an *Idea* as is here deſcrib'd. That Author acknowledges it doth 're'quire ſome Pains and Skill to 'Form this general *Idea* of a Tri'angle, *ibid.* But had he call'd to mind what he ſays in another place, *viz.* that '*Ideas* of mix'd Modes 'wherein any inconſiſtent *Ideas* are 'put together, cannot ſo much as 'exiſt in the Mind, *i. e.* be conceiv'd, *vid. b.* iii. *c.* 10. *ſ*, 33. *ibid.* I ſay, had this occur'd to his Thoughts, 'tis not improbable he'd have own'd it above all the Pains and Skill he was Maſter of, to form the above-mention'd *Idea* of a Triangle, which is made up of manifeſt, ſtaring Contradictions. That a Man of ſuch a clear Underſtanding, who thought ſo much, and ſo well, and laid ſo great a Streſs on Clear and Determinate *Ideas*, ſhou'd nevertheleſs talk at this rate, ſeems very ſurpriſing. But my Wonder is leſſen'd when I conſider, that the Source whence this Opinion of Abſtract Figures and Extenſion flows, is the prolific Womb which has brought forth innumerable Errors and Difficulties, in all Parts of Philoſophy, and in all the Sciences.

ces. But this Matter, taken in its full Extent, were a Subject too vaſt and comprehenſive to be inſiſted on in this place. I ſhall only obſerve that your Metaphyſicians, and Men of Speculation, ſeem to have Faculties diſtinct from thoſe of ordinary Men ; when they talk of General or Abſtracted Triangles and Circles, *&c.* and ſo peremptorily declare them to be the Subject, of all the Eternal, Immutable, Univerſal Truths in *Geometry*. And ſo much for Extenſion in *Abſtract*.

CXXVI. *Vacuum or pure Space, not common to Sight and Touch.*

Some, perhaps, may think pure Space, *Vacuum*, or Trine Dimenſion to be equally the Object of Sight and Touch. But tho' we have a very great Propenſion, to think the *Ideas* of Outneſs and Space to be the immediate Object of Sight ; yet if I miſtake not, in the fore-going Parts of this Eſſay, That hath been clearly Demonſtrated to be a meer Deluſion, ariſing from the quick and ſudden Suggeſtion of Fancy, which ſo cloſely Connects the *Idea* of Diſtance with thoſe of Sight, that we are apt to think it is it ſelf a proper and immediate Object of that Senſe, till Reaſon corrects the Miſtake.

CXXVII. *There is no Idea or kind of Idea, common to both Senſes.*

It having been ſhewn, that there are no Abſtract *Ideas* of Figure, and that it is impoſſible for us, by any Preciſion of Thought, to frame an *Idea* of Extenſion ſeparate from all other Viſible and Tangible Qualities, which ſhall be common both to Sight and Touch: The Queſtion now remaining is, whether the particular Extenſions, Figures, and Motions perceiv'd by Sight be of the ſame Kind, with the particular Extenſions, Figures, and Motions perceiv'd by Touch? In anſwer to which, I ſhall venture to lay down the following Propoſition, *viz.* *The Extenſion, Figures,*

gures, and Motions perceiv'd by Sight are ſpecifically Diſtinct from the Ideas *of Touch, called by the ſame Names, nor is there any ſuch thing as one* Idea, *or kind of* Idea *common to both Senſes.* This Propoſition may, without much Difficulty, be collected from what hath been ſaid in ſeveral Places of this Eſſay. But, becauſe it ſeems ſo remote from, and contrary to, the receiv'd Notions and ſettled Opinion of Mankind; I ſhall attempt to demonſtrate it more particularly, and at large, by the following Arguments.

CXXVIII. *Firſt Argument in Proof hereof.*

FIRST, When upon Perception of an *Idea*, I range it under this or that ſort; it is becauſe it's perceiv'd after the ſame manner, or becauſe it has a Likeneſs or Conformity with, or affects me in the ſame way as the *Ideas* of the ſort I rank it under. In ſhort, it muſt not be intirely new, but have ſomething in it Old, and already perceiv'd by me: It muſt, I ſay, have ſo much, at leaſt, in common with the *Ideas* I have before known and nam'd, as to make me give it the ſame Name with them. But it has been, if I miſtake not, clearly made out, that a Man Born Blind wou'd not, at firſt reception of his Sight, think the things he ſaw were of the ſame Nature with the Objects of Touch, or had any thing in common with them; but that they were a new Set of *Ideas*, perceiv'd in a new manner, and intirely different from all he had ever perceiv'd before. So that he wou'd not call them by the ſame Name, nor repute them to be of the ſame Sort, with any thing he had hitherto known. And ſurely, the Judgment of ſuch an unprejudic'd Perſon is more to be relied on in this Caſe, than the Sentiments of the generality of Men: Who in this, as in almoſt every thing elſe, ſuffer themſelves to be guided by Cuſtom, and the erroneous Suggeſtions of Prejudice, rather than Reaſon and ſedate Reflexion.

CXXIX. *Second Argument.*

Secondly, Light and Colours are allow'd by all to conſtitute a Sort or *Species*, intirely different from the *Ideas* of Touch: Nor will any Man, I preſume, ſay they can make themſelves perceiv'd by that Senſe. But there is no other immediate Object of Sight, beſides Light and Colours. It is therefore a direct Conſequence, that there is no *Idea* common to both Senſes.

CXXX. *Viſible Fignre and Extenſion, not diſtinct Ideas from Colour.*

It is, I know, a prevailing Opinion, even amongſt thoſe who have Thought and Writ moſt Accurately concerning our *Ideas*, and the Ways whereby they enter into the Underſtanding, that ſomething more is perciev'd by Sight, than barely Light and Colours with their Variations. The Excellent Mr. *Locke* termeth Sight ‘The moſt ‘Comprehenſive of all our Senſes, ‘conveying to our Minds the *I*-‘*deas* of Light and Colours, which ‘are peculiar only to that Senſe; ‘and alſo the far different *Ideas* ‘of Space, Figure, and Motion. *Eſſay on Hum. Underſtand. b* ii. *c.* 9. *ſ.* 9. Space or Diſtance, we have ſhewn, is no otherwiſe the Object of Sight than of Hearing. *vid. Sect.* XLVI. And as for Figure and Extenſion, I leave it to any one, that ſhall calmly attend to his own clear and diſtinct *Ideas*, to decide whether he has any *Idea* intromitted immediately and properly by Sight, ſave only Light and Colours. Or whether it be poſſible for him, to frame in his Mind a diſtinct Abſtract *Idea* of Viſible Extenſion, or Figure, excluſive of all Colour; and on the other hand, whether he can conceive Colour without Viſible Extenſion.

For my own part, I muſt confeſs, I am not able to attain ſo great a nicety of Abſtraction. I know very well that, in a ſtrict Senſe, I ſee nothing but Light and Colours, with their ſeveral Shades and Variations. He who beſide theſe, doth alſo perceive by Sight *Ideas* far different and diſtinct from them, hath that Faculty in a degree more perfect and comprehenſive than I can pretend to. I own indeed, that by the mediation of Light and Colours, other far different *Ideas* are ſuggeſted to my Mind. But then, upon this Score, I ſee no reaſon why the Sight ſhou'd be thought more Comprehenſive than the Hearing: Which beſide Sounds, which are pecular to that Senſe, doth by their Mediation ſuggeſt, not only Space, Figure, and Motion, but alſo, all other *Ideas* whatſoever that can be ſignified by Words.

CXXXI. *Third Argument.* *Thirdly*, It is, I think, an Axiom univerſally receiv'd, that *Quantities of the ſame Kind may be added together, and make one intire Sum.* Mathematicians add Lines together; but they do not add a Line to a Solid, or conceive it as making one Sum with a Surface. Theſe three Kinds of Quantity being thought incapable of any ſuch mutual Addition, and conſequently of being compared together, in the ſeveral ways of Proportion, are by them, for that reaſon, eſteem'd intirely Diſparate and Heterogeneous. Now let any one try in his Thoughts, to add a Viſible Line or Surface to a Tangible Line or Surface. So as to conceive them making one continu'd Sum or Whole. He that can do this, may think 'em Homogeneous; but he that cannot muſt, by the foregoing Axiom, think them Heterogeneous.

ous. I acknowledge my ſelf to be of the latter Sort. A Blue, and and a Red Line I can conceive added together into one Sum, and making one continu'd Line; but to make, in my Thoughts, one continu'd Line of a Viſible and Tangible Line added together is, I find, a Task far more difficult, and even inſurmountable by me: And I leave it to the Reflexion and Experience of every particular Perſon, to determine for himſelf.

CXXXII. *Confirmation drawn from Mr.* Molyneux's *Problem of a Sphere and a Cube, publiſh'd by Mr.* Locke.

A FURTHER Confirmation of our Tenent may be drawn from the Solution of Mr. *Molyneux*'s Problem, publiſh'd by Mr. *Locke* in his *Eſſay*. Which I ſhall ſet down as it there lies, together with Mr. *Locke*'s Opinion of it. ' *Suppoſe a Man Born Blind, and now* ' *Adult, and taught by his Touch to di-* ' *ſtinguiſh between a Cube, and a Sphere* ' *of the ſame Metal, and nighly of* ' *the*

‘ *the ſame Bigneſs, ſo as to tell, when*
‘ *he felt one and t’other, which is the*
‘ *Cube, and which the Sphere. Suppoſe*
‘ *then the Cube and Sphere placed*
‘ *on a Table, and the Blind Man*
‘ *to be made to See :* Quære, *Whether*
‘ *by his Sight, before he Touch’d them,*
‘ *he could now diſtinguiſh, and tell,*
‘ *which is the Globe, which the Cube.*
‘ To which the acute and judicious
‘ Propoſer Anſwers : *Not. For though*
‘ *he has obtain’d the Experience of, how*
‘ *a Globe, how a Cube affects his*
‘ *Touch ; yet he has not yet attained*
‘ *the Experience, that what affects*
‘ *his Touch ſo or ſo, muſt affect*
‘ *his Sight ſo or ſo : Or that a protuberant*
‘ *Angle in the Cube, that*
‘ *preſſed his Hand unequally, ſhall*
‘ *appear to his Eye, as it doth in*
‘ *the Cube.* I agree with this thinking
‘ Gentleman, whom I am proud
‘ to call my Friend, in his Anſwer
‘ to this his Problem ; and am of
‘ opinion, that the Blind Man, at
‘ firſt Sight, would not be able

'with certainty to ſay, which was 'the Globe, which the Cube, whilſt 'he only ſaw them. *Eſſay on Human Underſtanding. b.* ii. *c.* 9. *ſ.* 8.

CXXXIII. *Which is falſly ſolved, if the common Suppoſition be true.*

Now, if a Square Surface perceiv'd by Touch be of the ſame Sort, with a Square Surface perceived by Sight: It is certain the Blind Man here mention'd might know a Square Surface, as ſoon as he ſaw it. It is no more but introducing into his Mind, by a new Inlet, an *Idea* he has been already well acquainted with. Since therefore he is ſuppos'd to have known by his Touch, that a Cube is a Body terminated by Square Surfaces; and that a Sphere is not terminated by Square Surfaces: Upon the Suppoſition that a Viſible and Tangible Square differ only *in Numero*, it follows, that he might know, by the unerring Mark of the Square Surfaces, which was the Cube, and which not, whilſt he only ſaw them. We muſt therefore allow, either that Viſible Extenſion and Figures are Specifically diſtinct, from Tangible Extenſion and Figures, or elſe, that the Solution of this Problem, given by thoſe two very thoughtful and ingenious Men, is wrong.

CXXXIV. *More might be ſaid in proof of our Tenent, but this ſuffices.*

MUCH more might be ſaid together in Proof of the Propoſition I have advanced. But what has been ſaid is, if I miſtake not, ſufficient to convince any one that ſhall yield a reaſonable Attention. And, as for thoſe that will not be at the Pains of a little Thought, no Multiplication of Words will ever ſuffice to make them underſtand the Truth, or rightly conceive my Meaning.

CXXXV. *Farther Reflexion, on the foregoing Problem.*

I CANNOT let go the above-mention'd Problem, without ſome Reflexion on it. It hath been made evident, that a Man Blind from his Birth wou'd not, at firſt Sight, denominate any thing he ſaw by the Names, he had been us'd to appropriate to *Ideas* of Touch. *vid. Sect.* CVI. *Cube*, *Sphere*, *Table*, are Words he has known applied to Things perceivable by Touch, but to Things perfectly Intangible he never knew them apply'd. Thoſe Words in their wonted application, always mark'd out to his Mind Bodies, or ſolid Things which were perceiv'd by the Reſiſtance they gave. But there is no Solidity, no Reſiſtance or Protruſion perceiv'd by Sight. In ſhort, the *Ideas* of Sight are all new Perceptions, to which there be no Names annex'd in his Mind; he cannot, therefore, underſtand what is ſaid to him concerning them. And to ask, of the two Bodies he ſaw placed on the Table, which was the Sphere, which the Cube? Were, to him, a Queſtion down right Bantering and Unintelligible:

Nothing he ſees being able to ſuggeſt to his Thoughts, the *Idea* of Body, Diſtance, or in general, of any thing he had already known.

CXXXVI *The ſame thing doth not affect both Sight and Touch.*

'Tis a Miſtake, to think the ſame thing affects both Sight and Touch. If the ſame Angle or Square which is the Object of Touch, be alſo the Object of Viſion: What ſhou'd hinder the Blind Man, at firſt Sight, from knowing it? For tho' the manner wherein it affects the Sight, be different from that wherein it affected his Touch; yet, there being, beſide this Manner or Circumſtance, which is new and unknown, the Angle or Figure which is old and known, he cannot chuſe but diſcern it.

CXXXVII *The ſame Idea of Motion not common to Sight and Touch.*

Visible Figure and Extenſion having been demonſtrated, to be of a Nature intirely Different and Heterogeneous, from Tangible Figure and Extenſion, it remains that we inquire concerning *Motion.* Now, that Viſible Motion is not of the ſame Sort with Tangible Motion, ſeems to need no farther Proof, it being an evident Corollary from what we have ſhewn, concerning the Difference there is betwixt Viſible and Tangible Extenſion. But for a more full and expreſs Proof hereof, we need only obſerve, that one who had not yet experienced Viſion, wou'd not, at firſt Sight, know Motion. Whence it clearly follows, that Motion perceivable by Sight is of a Sort diſtinct from Motion perceivable by Touch. The Antecedent I prove thus. By Touch he cou'd not perceive any Motion, but what was up or down, to the right or left, nearer or farther from him; beſides theſe, and their ſeveral Varieties or Complications, it's impoſſible he ſhou'd have any *Idea* of Motion. He wou'd not therefore think any thing to be Motion, or give the name *Motion* to any *Idea*, which he cou'd not range under ſome or other, of thoſe particular Kinds thereof. But from *Sect*. XCV, it's plain that by the meer act of Viſion, he cou'd not know Motion upwards or downwards, to the right or left, or in any other poſſible Direction. From which I conclude, he'd not know Motion at all at firſt Sight. As for the *Idea* of Motion in *Abſtract*, I ſhall not waſte Paper about it, but leave it to my Reader, to make the beſt he can on't. To me 'tis perfectly Unintelligible.

CXXXVIII *The way wherein we apprehend Motion by Sight, eaſily collected from what hath been ſaid.*

The Conſideration of Motion, may furniſh a new Field for Inquiry. But ſince the manner wherein the Mind apprehends by Sight, the Motion of Tangible Objects, with the various Degrees thereof, may be eaſily collected, from what has been ſaid concerning the manner, wherein that Senſe doth ſuggeſt their various Diſtances, Magnitudes, and Situations; I ſhall not enlarge any farther on this Subject: But proceed to inquire what may be alleg'd, with greateſt appearance of Reaſon, againſt the Propoſition we have Demonſtrated to be true. For where there is ſo much Prejudice to be encounter'd a bare and naked Demonſtration of the Truth will ſcarce ſuffice. We muſt alſo, ſatisfie the Scruples that Men may Start, in favour of their preconceiv'd Notions, ſhew whence the Miſtake ariſes, how it came to ſpread, and carefully diſcloſe and root out thoſe falſe Perſwaſions, that an early Prejudice might have implanted in the Mind.

CXXXIX. Qu. *How Viſible and Tangible* Ideas *came to have the ſame Name if not of the ſame Kind.*

First, Therefore, it will be demanded, how Viſible Extenſion and Figures come to be call'd by the ſame Name, with Tangible Extenſion and Figures, if they are not of the ſame Kind with them? It muſt be ſomething more than Humour or Accident, that cou'd occaſion a Cuſtom ſo conſtant and univerſal as this, which has obtain'd in all Ages and Nations of the World, and amongſt all Ranks of Men, the Learned as well as the Illiterate.

CXL. *This accounted for without ſuppoſing them of the ſame Kind.*

To which I Anſwer, we can no more Argue *e. g.* a Viſible and Tangible Square to be of the ſame *Species*, from their being call'd by the ſame Name; than we can, that a Tangible Square and the Monoſyllable conſiſting of Six Letters, whereby it is mark'd, are of the ſame Species, becauſe they are both call'd by the ſame Name. It is cuſtomary to call written Words, and the Things they ſignify, by the ſame Name: For Words not being regarded in their own Nature, or otherwiſe than as they are marks of Things, it had been ſuperfluous,

ous, and beſide the deſign of Language, to have given them Names diſtinct from thoſe of the Things marked by them. The ſame Reaſon holds here alſo. Viſible Figures are the marks of Tangible Figures, and from *Sect.* LIX, it is plain, that in themſelves they are little regarded, or upon any other Score than for their Connexion with Tangible Figures, which by Nature they are ordain'd to ſignifie. And becauſe this Language of Nature does not vary, in different Ages or Nations, hence it is that, in all Times and Places, Viſible Figures are call'd by the ſame Names, as the reſpective Tangible Figures ſuggeſted by them: And not becauſe they are alike, or of the ſame ſort with them.

CXLI. Obj. *That a Tangible Square is liker to a Viſible Square than to a Viſible Circle.*

BUT ſay you, ſurely a Tangible Square is liker to a Viſible Square than to a Viſible Circle: It has four Angles, and as many Sides;

ſo alſo has the Viſible Square, but the Viſible Circle has no ſuch thing, being bounded by one uniform Curve, without right Lines or Angles; which makes it unfit to repreſent the Tangible Square, but very fit to repreſent the Tangible Circle. Whence it clearly follows, that Viſible Figures are Patterns of, or of the ſame *Species* with the reſpective Tangible Figures repreſented by them; that they are like unto them, and of their own Nature fitted to repreſent them as being of the ſame ſort; and that they are in no reſpect arbitrary Signs, as Words.

CXLII. Anſ. *That a Viſible Square is fitter than a Viſible Circle, to repreſent a Tangible Square.* I ANSWER it muſt be acknowledg'd, the Viſible Square is fitter than the Viſible Circle to repreſent the Tangible Square, but then it is not becauſe it's liker, or more of a Species with it. But, becauſe the Viſible Square contains in it ſeveral diſtinct Parts, whereby to mark the ſeveral diſtinct, correſponding Parts of a Tangible Square, whereas the Viſible Circle doth not. The Square perceiv'd by Touch hath four diſtinct, equal Sides, ſo alſo hath it four diſtinct, equal Angles. It is therefore neceſſary, that the Viſible Figure which ſhall be moſt proper to mark it, contain four diſtinct, equal Parts correſponding to the four Sides of the Tangible Square; as likewiſe four other diſtinct and equal Parts, whereby to denote the four equal Angles of the Tangible Square. And accordingly we ſee the Viſible Figures contain in them diſtinct Viſible Parts anſwering to the diſtinct Tangible Parts of the Figures ſignify'd, or ſuggeſted by them.

CXLIII. *But it doth not hence follow, that a Viſible Square is like a Tangible Square.*

But it will not hence follow, that any Viſible Figure is like unto, or of the ſame *Species* with, its correſponding Tangible Figure, unleſs it be alſo ſhewn, that not only the Number, but alſo the Kind of the Parts be the ſame in both. To Illuſtrate this, I obſerve that Viſible Figures repreſent Tangible Figures, much after the ſame manner that written Words do Sounds. Now, in this reſpect, Words are not Arbitrary, it not being indifferent, what written Word ſtands for any Sound. But it is requiſite, that each Word contain in it as many diſtinct Characters, as there are Variations in the Sound it ſtands for. Thus, the ſingle Letter *a* is proper to mark one ſimple uniform Sound; and the Word *Adultery* is accommodated to repreſent the Sound annext to it, in the Formation whereof, there being Eight different Colliſions, or Modifications of the Air by the Organs of Speech, each of which produces a difference of Sound, it was fit, the Word repreſenting it ſhou'd conſiſt of as many diſtinct Characters, thereby to mark each particular Difference or Part of the whole Sound. And yet no Body, I perſume, will ſay, the ſingle Letter *a* or the Word *Adultery* are like unto, or of the ſame Species with, the reſpective Sounds by them Repreſented. It is indeed Arbitrary that, in general, Letters of any Language repreſent Sounds at all; but when that is once agreed, it is not Arbitrary what Combination of Letters ſhall repreſent this or that particular Sound. I leave this with the Reader to purſue, and apply it in his own Thoughts.

CXLIV. *Why we are more apt to confound Viſible with Tangible* Ideas, *than other Signs with the Things ſignify'd.*

It muſt be confeſt, that we are not ſo apt to confound other Signs with the Things ſignified, or to think them of the ſame Species, as we are Viſible and Tangible *Ideas*. But a little Conſideration will ſhew us how this may well be, without our ſuppoſing them of a like Nature. Theſe Signs are conſtant and univerſal, their Connexion with Tangible *Ideas* has been learnt at our firſt Entrance into the World, and ever ſince, almoſt every Moment of our Lives, it has been occurring to our Thoughts, and faſtening and ſtriking deeper on our Minds. When we obſerve that Signs are variable and of Human Inſtitution, when we remember, there was a time they were not connected in our Minds, with thoſe things they now ſo readily ſuggeſt ; but, that their Signification was learned by the ſlow Steps of Experience. This preſerves us from confounding them. But, when we find the ſame Signs ſuggeſt the ſame Things all over the World ; when we know they are not of Human Inſtitution, and cannot remember that we ever learn'd their Signification ; but think that at firſt

Sight they would have ſuggeſted to us, the ſame Things they do now: All this perſwades us they are of the ſame *Species* as the Things reſpectively repreſented by them, and that it is by a natural Reſemblance they ſuggeſt them to our Minds.

CXLV. *Several other Reaſons hereof, aſſign'd.*

Add to this, that whenever we make a nice Survey of any Object, ſucceſſively directing the *Optic Axis* to each Point thereof; there are certain Lines and Figures diſcrib'd by the Motion of the Head or Eye; which, being in Truth perceiv'd by Feeling, do, nevertheleſs, ſo mix themſelves, as it were, with the *Ideas* of Sight, that we can ſcarce think but they appertain to that Senſe. Again, the *Ideas* of Sight enter into the Mind, ſeveral at once more diſtinct and unmingled, than is uſual in the other Senſes beſide the Touch. Sounds, for Example,

ample, perceiv'd at the ſame Inſtant, are apt to coaleſce, if I may ſo ſay, into one Sound. But we can perceive at the ſame time great variety of Viſible Objects, very ſeparate and diſtinct from each other. Now Tangible Extenſion being made up, of ſeveral diſtinct coexiſtent parts, we may hence gather another Reaſon, that may diſpoſe us to imagine a Likeneſs, or Analogy, between the immediate Objects of Sight and Touch. But nothing, certainly, does more contribute to blend and confound them together, than the ſtrict and cloſe Connexion they have with each other. We cannot open our Eyes, but the *Ideas* of Diſtance, Bodies, and Tangible Figures are ſuggeſted by them. So ſwift, and ſudden, and unperceiv'd is the *Tranſit* from Viſible to Tangible *Ideas*; that we can ſcarce forbear thinking 'em equally the immediate Object of Viſion.

THE

CXLVI. *Reluctancy in rejecting any Opinion, no Argument of its Truth.*

The Prejudice which is grounded on theſe, and whatever other Cauſes may be aſſign'd thereof, ſticks ſo faſt on our Underſtandings, that it is impoſſible without obſtinate Striving, and Labour of the Mind, to get intirely clear of it. But then the Reluctancy we find, in rejecting any Opinion, can be no Argument of its Truth, to whoever conſiders what has been already ſhewn, with regard to the Prejudices we entertain concerning the *Diſtance*, *Magnitude*, and *Situation* of Objects: Prejudices ſo familiar to our Minds, ſo confirm'd and inveterate, as they will hardly give way to the cleareſt Demonſtration.

CXLVII. *Proper Objects of Viſion, the Language of Nature.*

Upon the whole, I think we may fairly conclude, that the proper Objects of Viſion conſtitute the Univerſal Language of Nature, whereby we are inſtructed how to regulate our Actions, in order to attain thoſe things, that are neceſſary to the Preſervation and Well-being of our Bodies, as alſo to avoid whatever may be hurtful and deſtructive of them. It's by their Information that we are principally guided in all the Tranſactions and Concerns of Life. And the manner wherein they ſignify, and mark out unto us the Objects which are at a diſtance, is the ſame with that of Languages and Signs of Human Appointment; which do not ſuggeſt the things ſignify'd, by any Likeneſs or Identity of Nature, but only by an Habitual Connexion, that Experience has made us to obſerve between 'em.

CXLVIII *In it there is much admirable, and deſerving our attention.*

SUPPOSE one who had always continu'd Blind, be told by his Guide, that after he has advanced ſo many Steps, he ſhall come to the Brink of a Precipice, or be ſtopt by a Wall; muſt not this to him ſeem very admirable and ſurprizing? He can't conceive how 'tis poſſible for Mortals, to frame ſuch Predictions as theſe, which to him would ſeem as ſtrange and unaccountable, as Propheſy does to others. Even they who are Bleſſed with the Viſive Faculty, may (tho' Familiarity make it leſs obſerv'd) find therein ſufficient Cauſe of Admiration. The wonderful Art and Contrivance wherewith it is adjuſted, to thoſe Ends and Purpoſes for which it was apparently deſign'd, the vaſt Extent, Number, and Variety of Objects that are, at once, with ſo much Eaſe, and Quickneſs, and Pleaſure, ſuggeſted by it: All theſe afford Subject for much and pleaſing Speculation; and may, if any thing, give us ſome Glimmering, Analogous, Prænotion of Things, that are placed beyond the certain Diſcovery, and Comprehenſion of our preſent State.

CXLIX. *Queſtion propos'd, concerning the Object of Geometry*

I do not deſign to trouble my ſelf much with drawing Corollaries, from the Doctrine I have hitherto laid down. If it bears the Teſt, others may, ſo far as they ſhall think convenient, employ their Thoughts in extending it farther, and applying it to whatever Purpoſes it may be ſubſervient to. Only, I cannot forbear making ſome Inquiry concerning the Object of Geometry, which the Subject we have been upon does naturally lead one to. We have ſhewn there's no ſuch *Idea*, as that of Extenſion in Abſtract, and that there are two kinds of ſenſible Extenſion and Figures, which are intirely Diſtinct and Heterogeneous from each other. Now, it is natural to enquire which of theſe is the Object of *Geometry*.

CL. *At firſt View, we are apt to think Viſible Extenſion the Object of Geometry.*

Some things there are which, at firſt ſight, incline one to think Geometry converſant about Viſible Extenſion. The conſtant uſe of the Eyes, both in the Practical and Speculative Parts of that Science, doth very much induce us thereto. It would, without doubt, ſeem odd to a Mathematician, to go about to convince him, the Diagrams he ſaw upon Paper were not the Figures, or even the Likeneſs of the Figures, which make the Subject of the Demonſtration. The contrary being held an unqueſtionable Truth, not only by Mathematicians, but alſo by thoſe who apply themſelves more particularly to the Study of *Logick*; I mean, who conſider the Nature of Science, Certainty and Demonſtration: It being by them aſſign'd as one Reaſon, of the extraordinary Clearneſs and Evidence of Geometry, that in that Science the Reaſonings are free from thoſe Inconveniences, which attend the uſe of Arbitrary Signs. The very *Ideas* themſelves being Copied out, and expoſed to View upon Paper. But, by the bye, how well this agrees with what they likewiſe aſſert, of Abſtract *Ideas* being the Object of Geometrical Demonſtration, I leave to be conſider'd.

CLI. *Viſible Extenſion ſhewn not to be the Object of Geometry.*

To come to a Reſolution in this Point, we need only obſerve what has been ſaid in *Sect.* LIX, LX, LXI; where it is ſhewn, that Viſible Extenſions in themſelves are little regarded, and have no ſettled determinate Greatneſs; and that Men meaſure altogether, by the Application of Tangible Extenſion to Tangible Extenſion. All which makes it evident, that Viſible Extenſion and Figures are not the Object of Geometry.

CLII. *Words may as well be thought the Object of Geometry, as Viſible Extenſion.*

It is, therefore, plain that Viſible Figures are of the ſame Uſe in Geometry, that Words are. And the one may as well be accounted the Object of that Science, as the other; neither of them being any otherwiſe concern'd therein, than as they repreſent or ſuggeſt to the Mind the particular Tangible Figures connected with them. There is, indeed, this Difference betwixt the Signification of Tangible Figures by Viſible Figures, and of *Ideas* by Words. That whereas the Latter is variable and uncertain, depending altogether on the Arbitrary Appointment of Men; the Former is fix'd, and immutable the ſame, in all Times and Places. A Viſible Square, for Inſtance, ſuggeſts to the Mind the ſame Tangible Figure in *Europe*, that it doth in *America*. Hence it is, that the Voice of Nature, which ſpeaks to our Eyes, is not liable to that Miſinterpretation and Ambiguity, that Languages of Human Contrivance are unavoidably ſubjected to. From which may, in ſome meaſure, be derived that peculiar Evidence and Clearneſs of Geometrical Demonſtrations.

CLIII. *It is propos'd to enquire, what Progreſs an Intelligence that cou'd ſee, but not feel, might make in Geometry.*

Tho' what has been ſaid may ſuffice to ſhew what ought to be determin'd, with relation to the Object of Geometry; I ſhall nevertheleſs, for the fuller Illuſtration thereof, take into my Thoughts the Caſe of an Intelligence, or Unbody'd Spirit, which is ſuppos'd to ſee perfectly well, *i. e.* to have a clear Perception of the proper and immediate Objects of Sight, but to have no Senſe of *Touch.* Whether there be any ſuch Being in Nature or no, is beſide my Purpoſe to enquire. It ſuffices, that the Suppoſition contains no Contradiction it it. Let us now examine, what Proficiency ſuch a one may be able to make in *Geometry*. Which Speculation will lead us more clearly to ſee, whether the *Ideas* of Sight can poſſibly be the Object of that Science.

CLIV. *He cannot underſtand thoſe parts which relate to Solids, and their Surfaces and Lines generated by their Section.*

FIRST, then 'tis certain, the aforeſaid Intelligence could have no *Idea* of a Solid, or Quantity of three Dimenſions; which follows from its not having any *Idea* of Diſtance. We indeed are prone to think, that we have by Sight the *Ideas* of Space and Solids, which ariſes from our imagining that we do, ſtrictly ſpeaking, ſee Diſtance, and ſome parts of an Object at a greater Diſtance than others, which has been demonſtrated to be the Effect of the Experience we have, had, what *Ideas* of Touch are connected with ſuch and ſuch *Ideas* attending Viſion. But the Intelligence here ſpoken of is ſuppos'd to have no Experience of Touch. He wou'd not, therefore, judge as we do, nor have any *Idea* of Diſtance, Outneſs, or Profundity, nor conſequently of Space or Body, either immediately or by Suggeſtion. Whence it is plain, he can have no Notion of thoſe parts of Geometry, which relate to the Menſuration of Solids, and their Convex or Concave Surfaces, and contemplate the Properties of Lines generated by the Section of a Solid. The conceiving of any part whereof, is beyond the Reach of his Faculties.

CLV. *Nor even the Elements of plain Geometry.*

FARTHER, he cannot comprehend the manner wherein Geometers deſcribe a right Line or Circle: The Rule and Compaſs with their Uſe, being things of which it's impoſſible he ſhould have any Notion. Nor is it an eaſier matter for him, to conceive the placing of one Plain or Angle on another, in order to prove their Equality. Since that ſuppoſes ſome *Idea* of Diſtance, or External Space. All which makes it evident, our pure Intelligence could never attain to know, ſo much as the firſt Elements of plain Geometry. And, perhaps, upon a nice Enquiry, it will be found, he cannot even have an *Idea* of Plain Figures, any more than he can of Solids. Since ſome *Idea* of Diſtance is neceſſary, to form the *Idea* of a Geometrical Plain, as will appear to whoever ſhall reflect a little on it.

CLVI. *The proper Objects of Sight incapable of being managed as Geometrical Figures.*

All that is properly perceiv'd by the Viſive Faculty, amounts to no more than Colours with their Variations, and different Proportions of Light and Shade. But, the perpetual Mutability, and Fleetingneſs of thoſe immediate Objects of Sight, render them incapable of being managed after the manner of Geometrical Figures; nor is it in any Degree uſeful that they ſhould. It's true, there be divers of 'em perceiv'd at once; and more of ſome, and leſs of others. But accurately to compute their Magnitude, and aſſign preciſe determinate Proportions, between Things ſo Variable and Inconſtant, if we ſuppoſe it poſſible to be done, muſt yet be a very trifling and inſignificant Labour.

CLVII. *The Opinion of thoſe who hold plain Figures to be the immediate Objects of Sight, conſider'd.*

I MUST confeſs, it ſeems to be the Opinion of ſome very Ingenious Men, that flat or plain Figures are immediate Objects of Sight, tho' they acknowledge Solids are not. And this Opinion of their's is grounded on what is obſerv'd in Painting, wherein (ſay they) the *Ideas* immediately imprinted in the Mind, are only of Plains variouſly colour'd, which by a ſudden Act of the Judgment are changed into Solids. But, with a little Attention we ſhall find the Plains here mention'd, as the immediate Objects of Sight, are not Viſible, but Tangible Plains. For when we ſay that Pictures are Plains, we mean thereby, that they appear to the *Touch* Smooth and Uniform. But then this Smoothneſs and Uniformity, or, in other Words, this Plainneſs of the Picture, is not perceiv'd immediately by Viſion: For it appeareth to the Eye Various and Multiform.

CLVIII. *Plains, no more the immediate Objects of Sight than Solids.*

FROM all which we may conclude, that Plains are no more the immediate Object of Sight than Solids. What we ſtrictly ſee are not Solids, nor yet Plains variouſly colour'd; they are only Diverſity of Colours. And ſome of theſe ſuggeſt to the Mind Solids, and others Plain Figures; juſt as they have been experienced to be connected with the one, or the other. So that we ſee Plains, in the ſame way that we ſee Solids: Both being equally ſuggeſted by the immediate Objects of Sight, which accordingly are themſelves Denominated *Plains* and *Solids*. But tho' they are called by the ſame Names, with the Things mark'd by them, they are nevertheleſs of a Nature intirely different, as hath been Demonſtrated.

CLIX. *Difficult to enter preciſely into the Thoughts of the above mention'd Intelligence.*

WHAT has been ſaid is, if I miſtake not, ſufficient to Decide the Queſtion we propos'd to Examine, concerning the Ability of a pure Spirit, ſuch as we have deſcrib'd, to know *Geometry*. It is, indeed, no eaſy matter for us to enter preciſely into the Thoughts of ſuch an Intelligence; becauſe we cannot, without great Pains, cleverly Separate, and Diſintangle in our Thoughts, the proper Objects of Sight, from thoſe of Touch, which are Connected with them. This, indeed, in a compleat Degree,

gree, ſeems ſcarce poſſible to be perform'd. Which will not ſeem ſtrange to us, if we conſider how hard it is, for any one to hear the Words of his Native Language, which is familiar to him, pronounced in his Ears without underſtanding them. Tho' he endeavour to diſunite the meaning from the Sound, it will nevertheleſs intrude into his Thoughts, and he ſhall find it extream Difficult, if not impoſſible, to put himſelf exactly in the Poſture of a Foreigner, that never learnt the Language, ſo as to be affected barely with the Sounds themſelves, and not perceive the Signification annexed to them.

CXL. *The Object of Geometry, its not being ſufficiently underſtood, cauſe of Difficulty and uſeleſs Labour in that Science.*

By this time, I ſuppoſe, 'tis clear that neither Abſtract, nor Viſible Extenſion makes the Object of *Geometry*. The not diſcerning of which might, perhaps, have created ſome Difficulty, and uſeleſs Labour in *Mathe-*

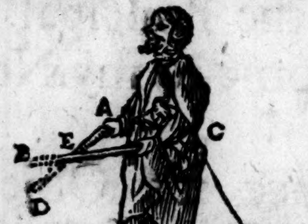
Mathematics. Sure I am, that ſomewhat relating thereto has occur'd to my Thoughts, which, tho' after the moſt anxious and repeated Examination I am forced to think it true, doth, nevertheleſs, ſeem ſo far out of the common road of *Geometry*, that I know not, whether it may not be thought Preſumption, if I ſhou'd make it publick in an Age, wherein that Science hath receiv'd ſuch mighty Improvements by new Methods; great Part whereof, as well as of the Ancient Diſcoveries, may perhaps loſe their Reputation, and much of that Ardor, with which Men ſtudy the *Abſtruſe and Fine Geometry* be abated, if what to me, and thoſe few to whom I have imparted it, ſeems evidently True, ſhou'd really prove to be ſo.

An Appendix.

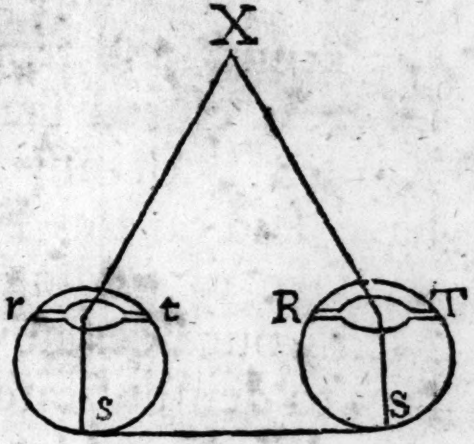
The Cenſures which, I am inform'd, have been made on the foregoing Eſſay inclin'd me to think I had not been Clear and Expreſs enough in ſome Points; and to prevent being miſunderſtood for the future, I was willing to make any neceſſary Alterations or Additions in what I had Written. But that was impracticable, the preſent Edition having been almoſt finiſh'd before I receiv'd this Information. Wherefore, I think it proper to conſider in this place the Principal Objections that are come to my Notice.

In the firſt place it's Objected, that in the beginning of the Eſſay I argue either againſt all uſe of Lines and Angles in *Optics*, and then what I ſay is falſe; or againſt thoſe Writers only who will have it that we can perceive by Senſe the Optic Axes, Angles &c. and then it's inſignificant, this being an abſurdity which no one ever held. To which I anſwer, that I Argue only againſt thoſe who are of Opinion that we perceive the Diſtance of Objects by Lines and Angles or, as they term it, by a kind of Innate Geometry. And to ſhew that this is not fighting with my own Shadow, I ſhall here ſet down a Paſſage from the Celebrated *Deſcartes*.

> *Distantiam præterea diſcimus, per mutuam quandam conſpirationem oculorum. Vt enim cæcus noſter duo bacilla tenens* A E *&* C E, *de quorum longitudine incertus, ſolumque intervallum manuum* A *&* C, *cum magnitudine angulorum* A C E, *&* C A E *exploratum habens, inde, ut ex Geometria quadam omnibus innata,*



nata, ſcire poteſt ubi ſit punctum E. *Sic quum noſtri oculi* RST *&* rst *ambo, vertuntur ad* X, *magnitudo lineæ* Ss, *& angulorum* XSs *&* XsS, *certos nos reddunt ubi ſit punctum* X. *Et idem opera alterutrius poſſumus indagare, loco illum movendo, ut ſi verſus* X *illum ſemper dirigentes, primo ſiſtamus in puncto* S, *& ſtatim poſt in puncto* s, *hoc ſufficiet ut magnitudo lineæ* S s, *& duorum angulorum* XSs *&* XsS *noſtræ imaginationi ſimul occurrant, & diſtantiam puncti* X *nos edoceant : idque per actionem mentis, quæ licet ſimplex judicium eſſe videatur, ratiocinationem tamen quandam involutam habet, ſimilem illi, qua Geometræ per duas ſtationes diverſas, loca inacceſſa dimetiuntur.*



I MIGHT amaſs together Citations from ſeveral Authors to the ſame Purpoſe, but this being ſo clear in the Point, and from an Author of ſo great Note, I ſhall not trouble the Reader with any more. What I have ſaid on this Head was not for the ſake of finding fault with other Men; but becauſe I judg'd it neceſſary to demonſtrate in the firſt place, that we neither ſee Diſtance immediately, nor yet perceive it by the mediation of any thing that hath (as Lines and Angles) a neceſſary connexion with it. For on the Demonſtration of this Point the whole Theory depends.

SECONDLY, It is Objected that the Explication I give of the Appearance of the Horizontal Moon (which may alſo be apply'd to the Sun) is the ſame that *Gaſſendus* had given before. I anſwer, there is, indeed, mention made of the Groſſneſs of the Atmoſphere in both, but then the

Methods wherein it is apply'd to ſolve the Phænomenon are widely different, as will be evident to whoever ſhall compare what I have ſaid on this Subject with the following Words of *Gaſſendus*.

HEINC dici poſſe videtur: Solem Humilem Oculo Spectatum ideo apparere majorem, quam dum altius egreditur, quia dum vicinus eſt Horizonti prolixa eſt Series vaporum, atque adeo corpuſculorum quæ Solis radios ita retundunt, ut Oculus minus conniveat, & Pupilla quaſi umbrefacta longe magis amplificetur, quam dum Sole multum elato rari vapores intercipiuntur, Solque ipſe ita ſplendeſcit, ut Pupilla in ipſum ſpectans contractiſſima efficiatur. Nempe ex hoc eſſe videtur, cur viſibilis ſpecies ex Sole procedens, & per Pupillam amplificatam intromiſſa in retinam, ampliorem in illa ſedem occupet, majoremque proinde creet Solis apparentiam, quam dum per contractam Pupillam eodem intromiſſa contendit. Vid. *Epiſt.* 1 *de ap-*

parente Magnitudine Solis Humilis & Sublimis, page *6*. This Solution of *Gaſſendus* proceeds on a falſe Principle, *viz*. That the Pupils being enlarged, Augments the Species or Image on the Fund of the Eye.

THIRDLY, Againſt what is ſaid in *Sect*. LXXX, it is objected, that the ſame thing which is ſo ſmall, as ſcarce to be diſcern'd by a Man, may appear like a Mountain to ſome ſmall Inſect; from which it follows, that the *Minimum Viſibile* is not equal in reſpect of all Creatures. I Anſwer, If this Objection be ſounded to the Bottom it will be found to mean no more, than that the ſame Particle of Matter, which is mark'd to a Man by one *Minimum Viſibile*, exhibits to an Inſect a great Number of *Minima Viſibilia*. But this does not prove, that one *Minimum Viſibile* of the Inſect is not equal to one *Minimum Viſibile* of the Man: The not diſtinguiſhing between the mediate and immediate Objects of Sight is, I ſuſpect, a cauſe of Miſapprehenſion in this Matter.

Some other Miſinterpretations and Difficulties have been made, but in the Points they refer to, I have endeavour'd to be ſo very plain, that I know not how to expreſs my ſelf more clearly. All I ſhall add is, that if they who are pleas'd to Criticiſe on my Eſſay, wou'd but read the whole over with ſome Attention, they might be the better able to comprehend my meaning, and conſequently to judge of my Miſtakes.

☞ *I am Inform'd that, ſoon after the Firſt Edition of this Treatiſe, a Man ſomewhere near* London *was made to See, who had been Born Blind, and continued ſo for about Twenty Years. Such a one may be ſuppoſed a proper Judge to decide, how far ſome Tenents laid down in ſeveral Places of the foregoing Eſſay, are agreeable to Truth,* *and if any Curious Perſon hath the Opportunity of making proper Interrogatories to him thereon, I ſhou'd gladly ſee my Notions either amended or confirmed by Experience.*

14/11/1906

FINIS.